Appendix A
ALTERNATIVES

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A.1 CONSOLIDATED PLUTONIUM CENTER (CPC)

CPC Requirements

- A CPC would consolidate all Category I/II security and hazard class defense programs mission activities requiring the use and handling of plutonium material. It would provide the facilities and equipment to perform pit manufacturing, pit surveillance, plutonium research and development, manufacturing process development, manufacture of parts for pit certification testing, and training of manufacturing and research and development personnel. A CPC would also consolidate and store all plutonium metal and other materials and parts required in support of these activities, and have supporting analytical chemistry and metallurgical capability.
- Stockpile requirements are based on national security requirements directed by the President based upon strategy and agreements between the Department of Energy (DOE) DOE and Department of Defense (DoD). CPC capacity and production output would be designed to meet the Reliable Replacement Warhead (RRW) requirements. Legacy pits would be supported as required through the use of contingency floor space, additions of required specific pit equipment, and development of specific procedures in handling required material. The facility would not be designed specifically to support all legacy pit types, but would accommodate any requirement for legacy pits as an adjustment to the equipment and facility capability designed for RRW pits with the use of contingency floor space and module flexibility.
- A CPC would provide the facilities and equipment to perform pit manufacturing, pit surveillance, and plutonium research and development.
- Stockpile requirements are based on national security requirements directed by the President and the Congress based on joint recommendations from DOE and DoD. CPC capacity and production output would be designed to meet national security requirements, which could include production of new pits for maintenance of the legacy stockpile or replacement weapons (e.g., RRWs).
- As described in Chapter 2, this SPEIS assumes that a CPC would provide a manufacturing capacity of 125 pits per year (ppy) using a single shift, with a contingency of 200 pits through multiple shifts. A CPC would be capable of supporting the surveillance program at a rate of one pit being destructively evaluated per pit type in the stockpile per year. For Los Alamos, this SPEIS also assesses an alternative that would result in a smaller pit production capacity (80 ppy), based on the use of the existing and planned infrastructure at that site.
- A newly constructed CPC would be constructed and started up over a six year period, and would be fully operational by approximately 2022. A CPC would be designed for a service life of at least 50 years.
- The sites being considered as potential locations for a CPC and consolidation of Category

I/II quantities of special nuclear material (SNM) include: Los Alamos, NTS, Pantex, SRS, and Y–12.

- A newly constructed CPC would consist of a central core area surrounded by a Perimeter Intrusion Detection and Assessment System (PIDAS), which would enclose all operations involving Category I/II quantities of SNM. The enclosed area would be approximately 40 acres. A buffer area would provide unobstructed view of the area surrounding the PIDAS. All administrative and non-SNM support buildings would be located outside the edge of the buffer area. Once operational, approximately 110 acres would be required for a new CPC (Table A.1-1). As shown in Table A.1-1, two CPC alternatives at Los Alamos (Upgrade Alternative and 50/80 Alternative) could reduce land area requirements by the use of existing and planned facilities and infrastructure.

Table A.1-1—Land Requirements for CPC Alternatives

	Construction (acres)	Operation (acres)	
Greenfield Alternative	140	110*	
		PIDAS	**Non-PIDAS**
		40	70
Upgrade Alternative	13	6.5 (All within PIDAS)	
50/80 Alternative	6.5	2.5 (All within PIDAS)	

* Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

- It is assumed that CPC facilities would be constructed above ground. During design activities, studies would be performed on worker safety, security enhancements, and costs. Examining whether the site of the CPC facilities above or below ground is an example of such a study. All five sites are assumed to be able to support a buried or partially buried/bermed facility. This SPEIS includes a discussion of the potential differences among the sites in supporting a buried or bermed facility (see Section A.1.5).
- If Los Alamos is not selected for the CPC mission, it is assumed that plutonium facilities at that site would be reduced to Category III or IV nuclear facilities for R&D purposes, or closure, after the CPC begins operations. Any residual non-Defense Program (DP) missions (i.e. Pu-238) would be responsible for funding to meet safety/security requirements. However, as explained in Section 3.4.1.6, facilities at Los Alamos are also being considered for upgrade to meet CPC requirements.
- SNM storage at the CPC would be based on the need to support a 3 month production period. Approximately 3 metric tons of storage is anticipated.
- Any transuranic (TRU) waste from a CPC is assumed to be disposed of at the Waste Isolation Pilot Plant (WIPP) (see Section 10.5.5).

A.1.1 CPC Operations

The following section discusses the operations for the CPC. The section begins with a summary of the pit production process that would occur in a CPC. The overall process would involve three main areas: 1) Material Receipt, Unpacking, and Storage; 2) Feed Preparation; and 3) Manufacturing.

A.1.1.1 *Material Receipt, Unpacking, and Storage*

Plutonium feedstock material would be delivered from offsite sources in DOE/Department of Transportation (DOT) approved shipping containers. The shipping containers would be held in Cargo Restraint Transporters (CRT) and hauled by Safeguards Transporters (SGTs). The bulk of the feedstock material would come from Pantex, in the form of pits from retired weapons. Additionally, small amounts of plutonium metal from LANL and SRS could be used. The CRTs would be unloaded from the truck and the shipping packages unpacked from the CRT. Each shipment would be measured to confirm the plutonium content, entered into the facility's Material Control & Accountability (MC&A) database, and placed into temporary storage. The shipping packages would later be removed from storage and opened to remove the inner containment vessel. Containment vessels with the feedstock material would then be measured for purposes of and transferred to the Receipt Storage Vault pending transfer to the Feed Preparation Area.

A.1.1.2 *Feed Preparation*

The containers would then be transferred through a secure transfer corridor to an adjacent Feed Preparation Area where plutonium metal is prepared for manufacturing. For pits to be recycled, the pit is first cut in half and all nonplutonium components are removed. Notable among these non-plutonium components is enriched uranium (EU), which would be decontaminated and then shipped to Y-12 for recycling. All of the other disassembled components would be decontaminated, to the maximum extent possible, and then disposed of as either low-level waste (LLW) or TRU waste, as appropriate.

There are two baseline processes currently being evaluated for the purification of the plutonium metal. One process relies more heavily on aqueous chemistry (aqueous process) and the other on pyrochemical reactions (pyrochemical process). The primary difference between the two processes is that the aqueous process does not employ chloride containing aqueous solutions, which means conventional stainless steels can readily be used to contain all of its processes. On the other hand, the pyrochemical process requires specialized materials to contain the corrosive chloride bearing solutions that it employs.

The primary process evaluated in this SPEIS is the aqueous process. This is a well known process, which has been successfully used at DOE sites for many years. It is comparatively simple and experiences few, but well controlled corrosion problems. This process requires more space than the pyrochemical process and does not produce as pure a product metal as the pyrochemical process. This lower purity requires additional processing runs and therefore produces significantly more waste than the pyrochemical process. The aqueous process provides a bounding analysis of the waste impacts from a CPC.

The pyrochemical process is more complex than the aqueous process, employing seven versus four major processing steps. However, this can be done in less space with more processing flexibility. It also produces very pure metal and a lower volume of waste. The purity of metal allows the pyrochemical process to have the option of only partially processing metallic plutonium to obtain adequate production purity. The pyrochemical process, however, requires special materials to contain the corrosive chloride solutions. Based on results from ongoing technology development, the pyrochemical process appears to have the greatest potential for improvements in efficiencies and in waste stream reductions. The pyrochemical process has been successfully used for many years at LANL.

The pyrochemical process has the potential to be environmentally more benign, thus having less environmental impact than the aqueous process. As the design of a CPC develops and a final purification process is selected, the site-specific, tiered EIS would evaluate in more detail the impact of the actual process to be used. Additionally, for a CPC that might be constructed at SRS, this SPEIS includes consideration of using facilities and infrastructure that are being constructed in support of the Materials Disposition Program. One particular facility, the Pit Disassembly and Conversion Facility (PDCF), could provide the capability to disassemble pits and convert the plutonium to a form suitable for producing new pits. The PDCF would include a hardened plutonium processing building, conventional buildings and structures housing support personnel, systems, and equipment (see Section 3.4.1.2).

A.1.1.3 *Manufacturing*

The pit manufacturing work includes the fabrication of the plutonium components for pits and the assembly of pits. A pit in this context is the assembly of all components into the full pit that is shipped to Pantex. Typically, non-plutonium parts would be government-furnished equipment and fabricated elsewhere. Non-plutonium components would be shipped to the CPC to be assembled along with the plutonium components into pits. A quality assurance acceptance program would be required to receive and accept non-plutonium parts. In addition, a bonded stores capability must be provided for interim storage of government-furnished equipment and other parts/materials for war reserve (WR) production. The CPC would require the capability to perform SNM shipping, receiving, and storage; pit disassembly and feedstock sampling; metal preparation, recovery, and refining; product forming, machining, welding, cleaning, and assembly; and product inspection (including radiography), process qualification, production surveillance, and analytical chemistry support. Supporting and ancillary functions (waste handling, security operations, training, maintenance, administration, process development, and testing) required to perform pit manufacturing are also included in the CPC. These capabilities would be applied to both WR production and production of parts/samples in support of certification and new production surveillance activities.

The CPC would deploy manufacturing processes that would enable the production of RRW pits as components for replacement of warheads in the enduring stockpile. The facility would be designed based on an agile facility concept, whereby processes could be changed out as new technologies are developed and limited additional capacity created as contingency for unforeseen requirements. Feedstock for the fabrication of the plutonium components would consist primarily of site-return pits requiring disassembly and reprocessing, but would also include purified metal from the CPC processing line. The capability to manufacture legacy pits would be retained through the agility and flexibility aspects of design with the manufacturing modules and floor space within the facility.

New pits would be inspected and prepared for storage and eventual shipment to Pantex. The majority of the waste from this process would be plutonium shavings that would be recycled within a CPC.

A.1.1.3.1 Manufacturing Process Development

During the projected lifetime of the facility, there would be changes in technology and changes in design of warheads where new processes and equipment would need to be developed and tested before they enter the production line. Process development requires both cold and hot space. Examples currently underway are foundry development where a new casting process is being developed to increase capacity and efficiency; metal purification where a new piece of equipment would accelerate activities, reduce radiation exposure, and reduce waste; machining where multi-functional equipment can replace the need for 3 or 4 separate pieces of equipment; new dimensional analysis to reduce time and improve accuracy of measurement; and module development to locate multiple pieces of equipment in a manner that increases efficiency within a set of operations. This area also provides capability for training new personnel, developing processes, and evaluating new equipment without unnecessary exposure to radiation.

A.1.1.3.2 Manufacture of Certification Parts

Besides the manufacture of pits for the stockpile, the manufacture of pits or parts of pits would be required for support of physics and engineering certification testing. In most instances, such pits or parts may be manufactured on the production line. Their production, however, must be considered in design of the floor space and equipment to ensure the production line is not interrupted in achieving its required capacity and output.

A.1.1.4 *Plutonium Research and Development*

The CPC would also conduct plutonium research and development. Plutonium research and development seeks to understand the properties and performance characteristics of plutonium, including fundamental thermodynamic, shock-induced deformation, intermediate strain-rate elastic-plastic behavior, spall, and surface ejecta. Understanding of the properties and performance characteristics supports modeling of weapon performance and provides assurance of stockpile reliability. Samples are prepared to support tests, such as those using the JASPER gas-gun facility at NTS. Parts are manufactured to support subcritical experiments to study specific fundamental plutonium properties. R&D also supports studies on plutonium aging to measure and understand weapon characteristics as the material ages. Sample fabrication requires the use of lathes, drill presses, tomography, metallographic equipment, polishing, precision machining and inspection, and rolling mill equipment. This research and development resource would also constantly assess the activities required for pit processing and work to develop new more efficient and environmentally preferred methods.

A.1.1.5 *Plutonium Pit Surveillance*

Pit surveillance is the periodic disassembly and inspection of pits removed from the active stockpile to help identify any defects or degradation and assure that nuclear weapons in the enduring stockpile are safe and reliable. Evaluations include leak testing, weighing, dimensional inspection, dye penetration inspection, ultrasonic inspection, radiographic inspection, metallographic analysis, chemical analysis, pressure tests, and mechanical properties testing.

A.1.2 CPC Facility Requirements

In order to allow for the pit production process, as described above, the CPC would require the design of facilities to allow for its operation. Although the overall specific requirements are still in the design stage, the general needs are clearly known and are as follows:

Security. The majority of CPC would be located within a PIDAS. The PIDAS would be a multiple-sensor system within a 30-foot wide zone enclosed by two fences that surround the entire Security Protection Area. There would be an Entry Control Facility (ECF) at the entrance to the Security Protection Area.

Process and R&D buildings. A proposed concept being evaluated for a CPC divides the major plant components into four separate buildings identified as Material Receipt, Unpacking, and Storage; Feed Preparation; Manufacturing; and R&D to perform the functions described in Section 3.1.1. The process buildings would be two-story reinforced concrete structures located aboveground at grade. The exterior walls and roofs would be designed to resist all credible man-made and natural phenomena hazards and comply with all NNSA security requirements.

The first story of each building would include plutonium processing areas, manufacturing support areas, waste handling, control rooms, and support facilities for operations personnel. The second story of each of the three process buildings would include the heating, ventilating, and air conditioning (HVAC) supply fans, exhaust fans and high-efficiency particulate air (HEPA) filters, breathing/plant/instrument air compressor rooms, electrical rooms, process support equipment rooms, and miscellaneous support space. Interior walls are typically reinforced concrete to provide personnel shielding and durability for the 50-year facility design life. Each of these processing buildings would have its own ECF, truck loading docks, operations support facility, and safe havens designed in accordance with applicable safety and security requirements. The three processing buildings would be connected by secure transfer corridors.

Support Buildings within the PIDAS. The major support structures located within the PIDAS would include an Analytical Support Building and a Production Support Building. The Analytical Support Building would contain the laboratory equipment and instrumentation required to provide analytical chemistry and metallurgical support for the CPC processes, including radiological analyses. The Production Support Building would provide the capability for performing nonradiological classified work related to the development, testing, staging and trouble-shooting of CPC processes and equipment. A number of other smaller structures also supporting a CPC would include standby generator buildings, fuel and liquid gas storage tanks, an HVAC chiller building, cooling towers, and an HVAC exhaust stack.

Support buildings outside the PIDAS. The major structures located outside the PIDAS would include an Engineering Support Building, a Commodities Warehouse, and a Waste Staging/TRU Packaging Building. This Waste Staging/TRU Packaging Building would be used for characterizing and certifying the TRU waste prior to packaging and short-term lag storage prior to ship-ment to the TRU waste disposal site. Parking areas and storm water detention basins would also be located outside the PIDAS. In addition, a temporary concrete batch plant and construction laydown area would be required during construction. A generic layout showing the major buildings and their relationship to each other is shown in Figure A.1.2-1. Table A.1.2-1 shows the dimension estimates. The overall plant layout in this generic representation is a greenfield campus type layout, and would be adapted to each site, as necessary. The actual footprint of all of the buildings, as shown in the table, is considerably less than the "developed" area from the generic layout. Thus, the actual developed site layout could be much less than that shown in Table A.1.2-2, and could fit any site with enough space for buildings footprint and adequate security standoff distances.

Table A.1.2-1—Dimensions for the CPC

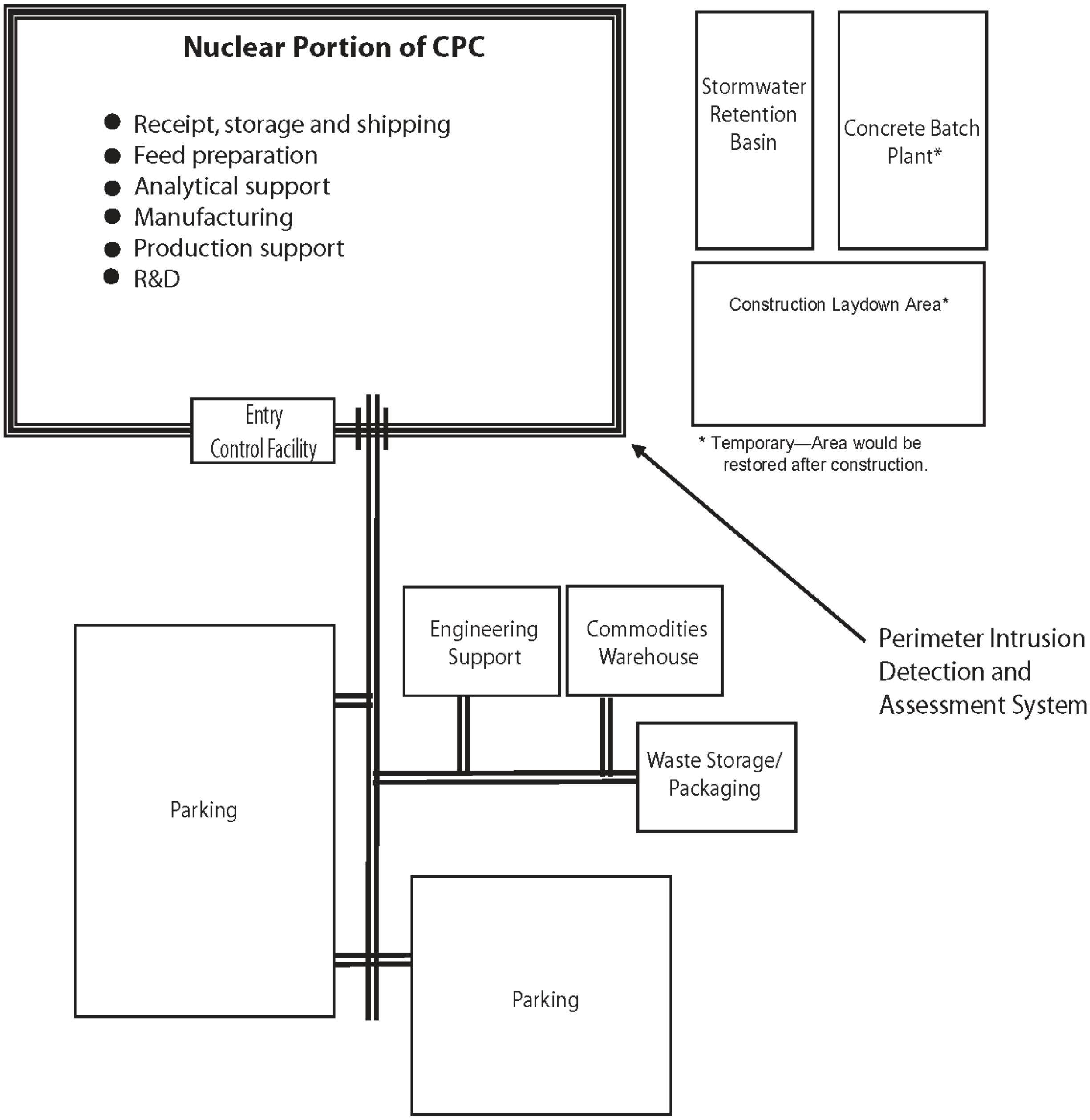
	Dimension
Processing Facilities Footprint (ft^2)	308,000
Support Facilities Footprint (ft^2)	280,000
Research and Development (ft^2)	57,000
Total Facilities Footprint (ft^2)	645,000
Area Developed During Construction (acres)	140
Post Construction Developed Area (acres)	110

Source: NNSA 2007.

A.1.3 CPC Transportation Requirements

The CPC would require transportation activities as described in this section. Plutonium pit assemblies would be shipped from Pantex to the CPC site. During startup, and potentially at other infrequent times, additional plutonium metal could be required. This additional plutonium could be shipped to the CPC from SRS. Additionally, as discussed in Section 3.4.1.4, once the CPC becomes operational, LANL would transfer its Category I/II plutonium to the CPC if LANL is not selected as the CPC site.

Both TRU waste and LLW would be generated at the CPC site. DOE's WIPP near Carlsbad, New Mexico, or a WIPP-like facility would be the destination for TRU waste from all CPC alternative sites. Three CPC site alternatives (LANL, NTS, and SRS) have low level waste (LLW) disposal facilities and would dispose of LLW onsite. Although Y-12 has some LLW disposal capability, it currently ships its LLW to NTS for disposal. Pantex does not have any LLW disposal capacity and would have to ship LLW to the NTS, if Pantex is selected as the CPC site. A matrix depicting the origins, destinations, and materials shipped is provided in Table A.1.3-1. The matrix also includes shipments under the No Action Alternative and LANL Upgrade Alternative (see Section 3.4.1.2). The number of shipments per year is presented in Table A.1.3-2.



Source: NNSA 2007.

Figure A.1.2-1—Generic Layout of a CPC

Table A.1.3-1—Origins, Destinations, and Material Shipped to Support the CPC

Shipment Type	CPC at SRS	CPC at Pantex	CPC at LANL	CPC at NTS	CPC at Y-12
LANL Plutonium in	LANL ⇒ SRS	LANL ⇒ Pantex	None	LANL ⇒ NTS	LANL ⇒ Y-12
Pits in	Pantex ⇒ SRS	None	Pantex ⇒ LANL	Pantex ⇒ NTS	Pantex ⇒ Y-12
EU in	Y-12 ⇒ SRS	Y-12 ⇒ Pantex	Y-12 ⇒ LANL	Y-12 ⇒ NTS	None
EU out	SRS ⇒ Y-12	Pantex ⇒ Y-12	LANL ⇒ Y-12	NTS ⇒ Y-12	None
Pits out	SRS ⇒ Pantex	None	LANL ⇒ Pantex	NTS ⇒ Pantex	Y-12 ⇒ Pantex
TRU waste out	SRS ⇒ WIPP	Pantex ⇒ WIPP	LANL ⇒ WIPP	NTS ⇒ WIPP	Y-12 ⇒ WIPP
LLW out	Onsite Disposal	Pantex ⇒ NTS	Onsite Disposal	Onsite Disposal	Y-12 ⇒ NTS

Materials Shipped. The materials which would require shipping are described as follows:

- ***SRS plutonium/LANL plutonium.*** This material is plutonium metal that is primarily plutonium-239, but contains other plutonium isotopes in small amounts. It would be used for start-up testing and once the CPC becomes operational could be infrequently shipped. Additionally, once the CPC becomes operational, LANL would transfer its Category I/II plutonium to the CPC if LANL is not selected as the CPC site (see Section 3.4.1.4).
- ***Pits.*** Pits would be the feed and product stream for the CPC. A pit is actually an assembly of plutonium metal. The plutonium is primarily plutonium-239, and the uranium is primarily uranium-235. A single shipment of pits would contain several hundred pounds of plutonium and uranium. In order to produce 125 ppy it is estimated that 7 annual round trips (or 14 total) would be required.
- ***EU.*** The EU parts from disassembled pits would be shipped to Y-12 for processing and returned to the CPC. A single shipment of EU contains more than a thousand pounds of uranium.
- ***TRU waste.*** Processing of plutonium pits would produce contact-handled TRU waste, primarily americium-241. It is estimated that this would require about 74 shipments per year to the WIPP in New Mexico or a WIPP-like facility
- ***LLW.*** This waste would consist of job control waste and decontamination wastes. The radioisotopes would primarily be TRUs, but their concentrations would be sufficiently low to classify the waste as LLW. Approximately 0.1 percent of the volume analyzed for shipping LLW would be mixed (MLLW). Waste generation is expected to sufficiently low to allow for disposal onsite for all candidate sites, except for Y-12 and Pantex, which would ship its LLW either to NTS or a commercial LLW disposal facility. It is estimated that this would require up to 10 shipments per year.

Table A.1.3-2—Numbers of Shipments per Year for the CPC

Transported Materials	200 ppy
Pits	22
TRU waste	118
Total	**156**

Source: NNSA 2007.

A.1.4 Differences Between a CPC and the Rocky Flats Plant

A CPC would be designed and operated to minimize risk to both workers and the general public during normal operations and in the event of an accident. Benefiting from decades of experience, a CPC would employ modern processes and manufacturing technologies and would utilize an oversight structure for safety, environmental protection, and management oversight that has been established since the closure of the Rocky Flats Plant.

A.1.4.1 *Building Design*

Modern safety and security design standards of today require substantially different structures from the earlier pit manufacturing facilities at the Rocky Flats Plant, near Golden, Colorado. The buildings at the Rocky Flats Plant were constructed in the 1950s with metal roof sheeting covered by a builtup weather seal. In contrast, the exterior walls and roof of PF-4 (the current interim production plutonium machining facility at LANL) are constructed of reinforced concrete greater than a foot thick. Internal walls at PF-4 provide multiple-hour fire barriers between wings. A CPC would be designed with similar improvements.

A.1.4.2 *Fire Control*

Although DOE experienced accidents associated with the manufacture of plutonium pits, most of these accidents occurred in a relatively short time period (from 1966 to 1969) at the Rocky Flats Plant. The majority of these accidents involved plutonium metal and chips undergoing spontaneous ignition. Such events can occur when the environment they are in allows for the rapid oxidation of plutonium, often in association with a moist air environment. Efforts at Rocky Flats concentrated on the elimination of such fires. It is now recognized that potential for fire initiation cannot be totally eliminated. Although the frequency and severity of fires can be reduced through the management of combustible materials and facility design, such events are now anticipated and planned for in the structural and process design and operational procedures. Engineering monitoring systems would be activated if a fire were to occur. These systems would activate controls and procedures to control, quickly suppress, and contain fires within the specific originating glovebox, minimizing the risk to workers and the general public.

Today, plutonium machining activities are conducted in gloveboxes supplied with an inert gas. Furthermore, gloveboxes are now equipped with exhaust filter systems. All working areas are separately vented with systems containing HEPA filters. These HEPA filters are fabricated of special nonflammable bonded material. Filter plenums are equipped with an automatic cooling system to reduce the temperature of the air reaching the final stages of HEPA filters. Unlike Rocky Flats, a CPC would have an automatic fire detection and suppression system designed to meet the latest National Fire Protection Association life safety codes and standards for manufacturing facilities. The design features would include multiple zones for both fire detection and suppression to assure that any fire which may occur would be isolated in small, separated areas of the facility and thereby preclude the spread of fire to other separated areas or the entire building.

A.1.4.3 *Waste Management and Material Control*

A CPC would have a dedicated waste handling area capable of preparing waste for transport in accordance with established procedures and waste acceptance requirements. In addition, all waste streams to be generated by the CPC would have an established disposition path for each alternative being considered. Since the CPC SEIS analyzes operations over a 50-year period, it is reasonable to expect that some disposition paths may change. A CPC would utilize a stringent MC&A system to accurately account for all SNM.

A.1.5 Above Ground Versus Below-Grade or Bermed CPC

An above ground facility is the basic preconceptual design configuration for a CPC. During conceptual design, a below grade facility configuration would be considered during the conduct of alternative studies. Although an above-grade facility can be designed to meet required security from the present design basis threat, a below-grade facility provides for a more passive security design with less reliance on active security systems and can provide additional physical security protection. However, a below grade facility poses additional life-safety considerations to protect personnel in an emergency and for them to be able to egress the facility in a timely manner. These issues together with physical security would be explored during a conceptual design period.

With regard to environmental considerations, a preconceptual design representation of a below grade production building, bermed with a concrete overcap, would require 25–50 percent more acreage than an above grade facility due to the extension of the berm to the physical structure. This soil overburden has the potential to reduce challenges to the building confinement system from events such as external fires and tornados. As much as 100 percent more concrete in volume is estimated to be necessary for support structures and an overcap, together with a 100–200 percent increase in the volume of material excavated, backfilled, and compacted. A 25 percent increase in asphalt paving is also estimated to take place.

There are additional costs and schedule increases estimated for a below-grade facility. Additional project costs are estimated to be between $100 million to $500 million depending upon both the design and the soil characterization. For example, a below-grade facility with soft soil and some involvement of groundwater might only add as little as two to three months to the project schedule. However, a 100 percent solid bedrock earthwork could take an additional two-and-a-half to three years for excavation. Both examples provide bounding estimates with no site expected to be 100 percent solid bedrock.

As part of a preliminary business case analysis for this SPEIS, NNSA has evaluated the issues, challenges, advantages and disadvantages of underground facilities. The information in this section is summarized from that report.[1] For each of the five sites considered in this SPEIS (Los Alamos, NTS, Pantex, SRS, and Y-12), two "cut-and-fill" options were assessed: 1) A buried facility with about 5 feet of soil cover; and 2) A facility buried at 20 feet below grade (i.e., 20 feet of soil cover). With any cut-and-fill option, a relatively shallow depression is excavated in the earth, the facility is built, followed by back-filling to bury the structure. The 5-feet

[1] Independent Business Case Analysis of Consolidated Options for the Defense Programs SNM and Weapons Production Mission, September 2007, Preliminary Draft, Prepared.

underground option was evaluated because this depth provides the equivalent overpressure protection as hardening gives an above-ground building. The 20-feet underground option was evaluated because a concrete breaker slab over this earth cover would protect the facility from the impact of a fully loaded airliner. Modeling of the effects of the impact of an aircraft show that, for the worst case, nine feet of earth cover will prevent penetration of aircraft parts, and a design for a 50 psi overpressure will protect from the blast from the detonation of the aircraft fuel. The building designed for the 35 psi overpressure buried 20 feet deep is capable of withstanding the 50 psi surface blast.

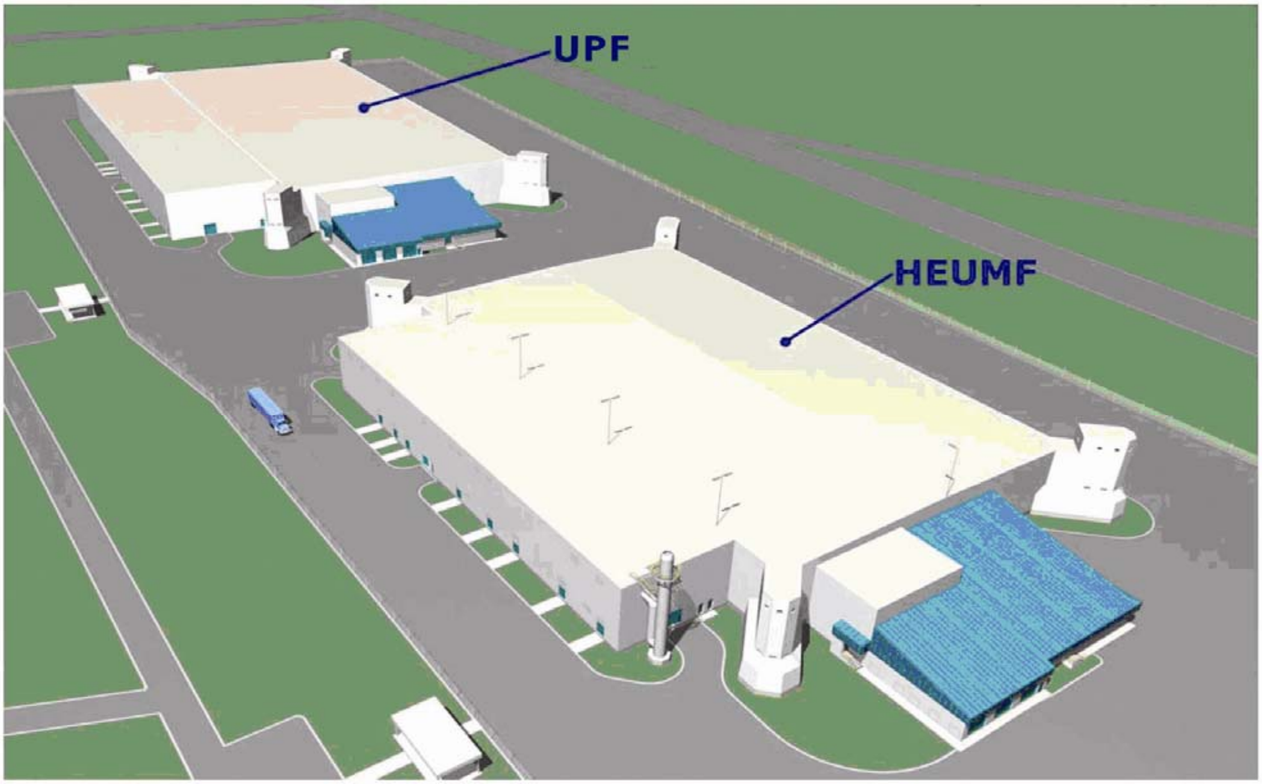
Building underground would require increased excavation and the need to construct the roof slab and roof slab support system to support the pressure from the earth cover. Conversely, the walls underground do not need to be as robust as the equivalent above ground structure. Underground buildings could use earth to shield between structures and to contain migration of materials in an accident. Underground facilities could be constructed in stages or modules connected to one another via underground passages after the construction is completed. This would allow facility expansion in stages and consolidation of activities at a single site.

The results from this feasibility study show putting nuclear facilities underground is not a significant discriminator among the proposed five sites as all five sites can employ underground construction. All of the proposed sites for the CPC/Consolidated Nuclear Center (CNC)/Consolidated Nuclear Production Center (CNPC) were assessed to be capable of using underground construction. For sites where the water table is high or the earth is less amenable to excavation, most of the cover for the building can be bermed by bringing in fill material. In addition, the underground options are more robust in meeting the DBT and will likely be capable of adapting to changes in the DBT in the future. Proper planning of the underground facilities can allow expansion without a significant change in the PIDAS or the protective force. This could lead to a consolidation strategy which could occur in stages over a number of years.

Modeling showed that the underground facility (5 or 20, no difference) could be protected with 85 less security guards than the same structure above ground. In addition, this modeling showed that the reduced guard force required two hardened fighting positions versus the five hardened fighting positions required for the above ground construction. Seismic resistance is improved slightly for both the structure and sensitive equipment underground. However, worker safety and construction would be much more complex for the underground option.

A.2 URANIUM PROCESSING FACILITY (UPF) AT Y-12

The UPF would replace multiple existing enriched uranium (EU) and other processing facilities. The current operating and support areas occupy approximately 633,000 square feet in multiple buildings, while the consolidated UPF would result in approximately a 33 percent reduction, to approximately 400,000 square feet in one building. Once the UPF becomes operational, some of those existing facilities would be available for decontamination and decommissioning (D&D), while other facilities could be used for non-EU processes. Figure A.2-1 shows an artist’s rendering of the proposed UPF. Figure A.2-2 shows the location of the UPF relative to other buildings at Y-12.



Source: NNSA 2005c.

Figure A.2-1—Artist's Rendering of the UPF Adjacent to the HEUMF

A.2.1 UPF Construction

The new structures and support facilities that would comprise the UPF complex include the following:

- UPF building;
- UPF electrical switching center;
- Chiller building and chiller building switch center; cooling tower;
- Aboveground water tank for a seismic-qualified firewater system with a firewater pumping facility;
- Electrical generators; and
- Modified PIDAS to encompass the UPF complex.

The design service life of the UPF would be 50 years. The UPF would be equipped with safety support systems to protect workers, the public, and the environment. The UPF would be housed in a multistory, reinforced concrete building designed and built for security. The main building would be a reinforced concrete structure with reinforced concrete exterior walls, floor slabs, and roof. The roof and exterior walls would be sized to protect the interior from tornado- and wind-borne missiles and blast effects.

Conventional construction techniques would be used to build the UPF. The preliminary schedule for the project indicates that site preparation would begin in approximately 2011, with completion by approximately 2016, and operations beginning by approximately 2018. Construction activities would be performed in a manner that assures protection of the environment during the construction phase. Disposal of construction debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the construction process, storm water management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

As shown on Figure A.2-2, construction of the UPF would require approximately 35 acres of land, which includes land for a construction laydown area and temporary parking. Once constructed, the UPF facilities would take up approximately eight acres. The construction laydown area for the UPF would be developed on the west side of the proposed UPF site. This area would be finished with an eight-inch thick compacted, stabilized base for the construction phase. Interim employee parking lots would be developed west of the proposed construction laydown area. The site would be sufficiently graded and developed to accommodate a number of temporary construction trailers, storage buildings, and materials storage yards. After construction of the UPF is complete, it may be feasible to rework the laydown area to provide for additional parking.

A.2.2 Traffic Planning and Parking

The entrance road to the existing Polaris parking lot would be relocated to facilitate site work. Up to 1,200 car spaces may be built to replace the parking spaces lost when the proposed UPF is constructed. Further PIDAS modifications would be constructed to encompass the Highly Enriched Uranium Maerials Facility (HEUMF) (under construction) and the proposed UPF.

A.2.3 Site Preparation and Facility Construction

Site preparation would include any excavation, filling, and grading needed to meet design requirements for an on-grade, reinforced concrete structure. Detailed testing would be conducted to fully characterize site geology, hydrology, and soil compaction, as well as to sample for radioactive contamination, mercury, and other materials of concern before construction.

The structure's foundation would be concrete piers that are drilled down into the bedrock of the site, or a thick concrete slab. To reduce the overall footprint of the structure, a precast-concrete crib retaining wall would be constructed on the north and west sides of the UPF would be constructed with the same rigorous natural phenomena (NP) resistance design as the HEUMF, which is defined as Performance Category[2] (PC) 3.

[2] Performance Categories classify the performance goals of a facility in terms of facility's structural ability to withstand natural phenomena hazards (i.e., earthquakes, winds, and floods). In general, facilities that are classified as: PC 0 do not consider safety, mission, or cost considerations; PC 1 must maintain occupant safety; PC 2 must maintain occupant safety and continued operations with minimum interruption; PC 3 must maintain occupant safety, continued operations, and hazard materials confinement; and PC 4 must meet occupant safety, continued operations, and confidence of hazard confinement**.**

A.2.4 Security Considerations

Upon completion of construction, both the UPF and the HEUMF (which is already under construction and will have its full PIDAS in place) would be surrounded by a PIDAS security barrier. The PIDAS would be a multiple-sensor system within a 30-foot wide zone enclosed by two fences that surround the entire Security Protection Area.

A.2.5 UPF Operations

The core operations of the new consolidated UPF would be assembly, disassembly, Quality Evaluation, specialized chemical and metallurgical operations of EU processing, and product certification/inspection. The full range of operations would include:

- Assembly of subassemblies from refurbished and new components;
- Disassembly or dismantlement of returned weapons subassemblies resulting in recycle;
- Refurbishment, surplus generation, and disposal of components;
- Product certification through dimensional inspection, physical testing, and radiography;
- Quality evaluation (specially designed tests and inspections to collect data and determine the condition of units and components to assess the future reliability of the weapons systems in the stockpile);
- Metallurgical operations, including EU metal casting, rolling, forming, and machining;
- Analytical services for uranium; and
- Chemical processing, including conversion to uranium compounds and metal from salvage scrap and oxides. Chemical processing streams would be provided to process high enrichment, mixed enrichment, and special EU materials.

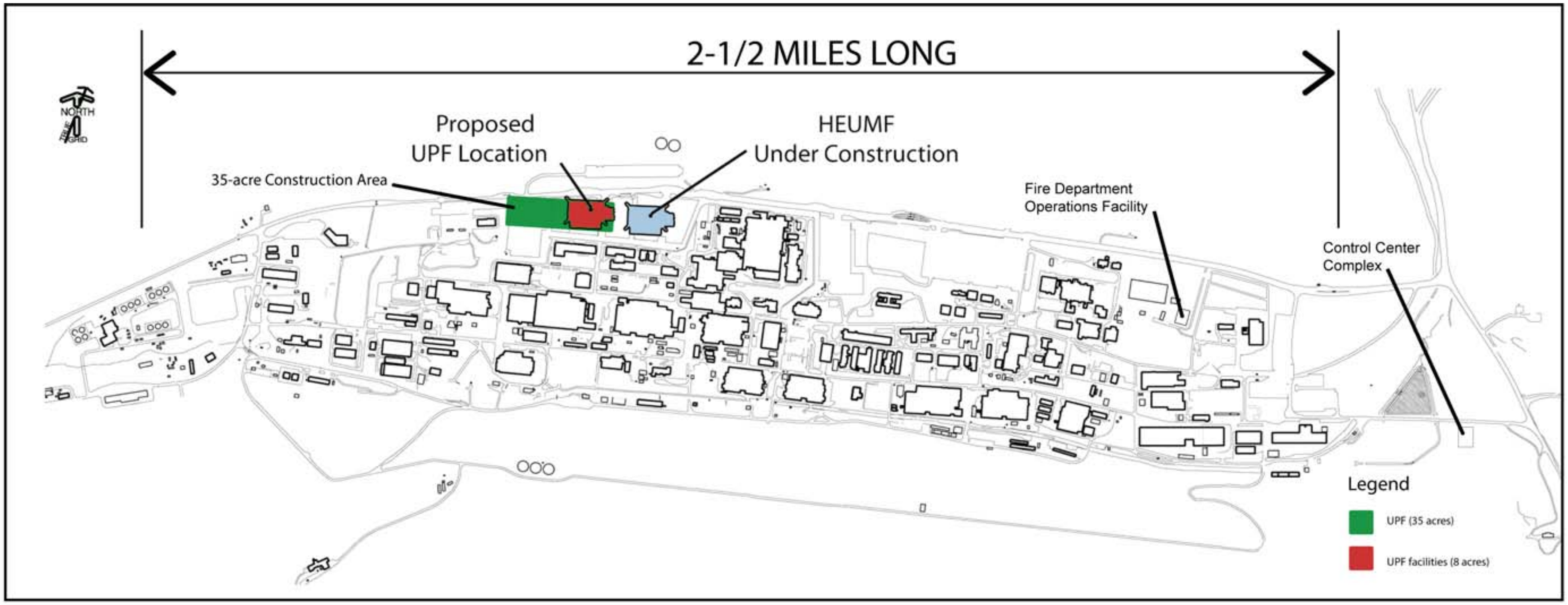


Figure A.2-2—Location of the UPF Relative to Other Buildings at Y-12

A.2.6 Utility and Safety Support Systems

The material processing areas within the UPF would incorporate the appropriate use of gloveboxes, inert atmosphere, negative air pressure, and other engineered controls, supported by administrative controls, to protect workers and the public from exposure to radiological and hazardous materials. Exhaust emissions for the facility would comply with the applicable Federal and State requirements. In conjunction with other engineered containment measures, the ventilation system barriers would provide a layered system of protection.

Other systems that would be included in the new UPF for facility operation and ES&H protection include:

- Criticality accident alarm system;
- Emergency notification system;
- Alarm system;
- Fire suppression alarm systems;
- Telephone and public address system;
- Classified and unclassified computer network;
- Personnel monitoring system;
- Security-related sensors; and
- Automated inventory system with continuous real-time monitoring.

The UPF would use a three-level negative air pressure approach to maintaining containment of particulate- and vapor-contaminated air, with the area having the lowest air pressure (i.e., highest negative air pressure) being primary containment. Secondary containment would be maintained at a lesser negative pressure, while the office and administrative areas would be maintained at a positive pressure with respect to the secondary containment areas. The primary containment ventilation system would consist of fans and collection ducts, scrubbers, mist eliminators, instrumentation, and HEPA filter banks. A secondary containment ventilation system would provide containment, negative pressure confinement, monitoring, and treatment for exhaust air from secondary containment areas frequented or occupied by operating personnel as well as other areas subject to contamination.

HEPA filters would be used in all process exhaust air streams to limit releases of EU. HEPA filters installed for this purpose would be performance qualified to limit offsite exposures to the public and releases to the environment. Current plans have a single exhaust stack being used as a central air emission point from the facility. All UPF process and exhaust air streams would be discharged from this stack, which would be located and designed to optimize the effects of plume dilution from the prevailing winds as well as to minimize the possibility of cross-contamination through the UPF and other Y-12 facility ventilation air intakes. The UPF discharge stack would be equipped with continuous emissions monitors for radiological emissions to meet Y-12 requirements to comply with environmental laws and reporting required data to the State of Tennessee as evidence of meeting those requirements.

Potable water, process water, and safety shower water would be supplied through the utility access corridors. The potable water would be used for sanitary purposes. Process water would be provided by a dedicated system. Safety shower water also would be provided by a dedicated system.

A dedicated breathing air system would be installed within the UPF and would consist of dedicated compressors, receivers, filters, dryers, monitoring instrumentation and alarms, distribution piping, and breathing air stations at multiple points of use throughout the facility.

Liquid effluent monitors would be installed in all discharge lines from processes handling uranium metal or uranium compounds. Systems would be designed to detect and record concentrations in parts per million of uranium in solution. Discharge streams exceeding established limits for concentrations of uranium would be automatically diverted to geometrically safe holdup tanks.

A defense-in-depth approach would be used in the UPF to prevent the occurrence of a fire and ensure that sufficient means are provided to detect and suppress fires. The facility would be fully sprinklered (except for X-ray vaults), which would enable the performance of process operations except where the presence of water is a criticality safety concern. All systems, equipment, and processes would be designed in accordance with appropriate fire protection codes, building codes, and other available safety documentation. In addition to the water suppression capabilities, fire extinguishers would be installed throughout the facility.

The UPF would be built of noncombustible materials so that the building structure would not contribute to the fire loading. The process building would be separated from all other significant facilities. Roadways serving the UPF would provide access, from either direction, to any point on the exterior of the building and would be configured to allow emergency vehicles to maintain a standoff distance of 50 feet. Fire hydrants would be located 50 feet from the building with the pumper connection pointing to an accessible paved area.

Extension of the current fire alarm system would support UPF fire alarm needs. All water flow, smoke, and heat detection would be alarmed. Fire hazards and potential losses inside the UPF would be controlled. Storage for combustibles would be minimized in processing areas and would be properly stored in areas established for such materials. Use of flammable liquids and gases would be minimized to the extent practical. Bulk storage of flammable gases would be located outside the building, and appropriate excess flow valves would be installed in gas supply systems to stop flow in the event of a line break.

Two new 161- 13.8- kilovolt substations north of the UPF would provide electrical power to the UPF. For the purposes of this SPEIS, underground electric utility construction would be utilized. Auxiliary electrical power would be provided for safety and operational support utilizing hydrocarbon burning engine/generator sets.

A.2.7 Upgrades to Existing Enriched Uranium Facilities at Y-12

The upgrade projects proposed would be internal modifications to the existing facilities and would improve worker health and safety, enable the conversion of legacy SNM to long-term storage forms, and extend the life of existing facilities. For continued operations in the existing facilities, major investments will be required for roof replacements; structural upgrades; HVAC replacements; and fire protection system replacement/upgrades. The projects would improve airflow controls between clean, buffer, and contamination zones; upgrade internal electrical distribution systems; and upgrade a number of building structures to comply with current NP criteria (BWXT 2004a).

For the purpose of this analysis, it is assumed that the upgrades would be performed over a 10-year construction period, following issuance of this SPEIS Record of Decision (ROD). This would enable the National Nuclear Security Administration (NNSA) to spread out the capital costs associated with the upgrades, and minimize disruption of operations.

Conventional construction techniques would be used for upgrade projects. Under this alternative, a preliminary schedule for the project indicates that site preparation would begin in 2008, with upgrades complete in approximately 2018. Upgrade activities would be performed in a manner that assures protection of the environment during the construction phase. Techniques would be used to minimize the generation of debris that would require disposal. Disposal of debris would be made in accordance with waste management requirements in properly permitted disposal facilities. Throughout the upgrade construction process storm water management techniques, such as silt fences and runoff diversion ditches, would be used to prevent erosion and potential water pollutants from being washed from the construction site during rainfall events.

NP: structural. The current authorization basis for many of the EU buildings has been designated as PC 2, which means these buildings must maintain occupant safety and continued operations with minimum interruption. An assessment of the structural adequacy of the buildings indicates they do not meet current codes and standards related to NP events (e.g., tornados and earthquakes) required for a PC 2 designation. If the buildings are intended to operate an additional 50 years, they would require structural upgrades to bring the buildings into compliance (BWXT 2004a).

Fire protection. The existing fire protection systems for many of the EU buildings are primarily piping systems operating under the Code of Record in effect at the time of installation. These codes have changed significantly over the years, and if the life of facility is intended to be extended any significant length of time, the systems may need to be upgraded to meet current codes and standards if exemptions for continued operations are denied. Upgrades would likely require total replacement of the current systems. Replacements would be required for sprinkler systems, riser replacements, and underground supply line upgrades (BWXT 2004a).

Utilities replacement/upgrades: mechanical systems. HVAC systems have an expected life in the range of 25–30 years. Many of the systems serving the EU building are beyond or are approaching the end of their useful life and are in need of replacement. The majority of the HEPA filters are located in antiquated systems. These systems also do not include test sections that allow the systems to be tested without removal of the prefilters. This arrangement subjects the filter change crews to added exposures compared to currently available filters with test sections. The continued long-term operations of existing facilities would require these filter systems to be replaced (BWXT 2004a).

Roofing. Most existing roofs for the EU buildings would need replacing (BWXT 2004a).

A.3 CONSOLIDATED NUCLEAR PRODUCTION CENTER

Program Requirements

- The CNPC would be sized and configured to support the U.S. nuclear weapons stockpile projected to exist after full implementation of the *Moscow Treaty*. The CNPC capacity would be sized to support delivery of 125 weapon assemblies per year in five-day, single shift operations. Multiple shift operation would yield up to 200 weapon assemblies per year.
- Sufficient capacity would be provided at the CNPC to support 75 weapon surveillance units per year. A capacity to perform up to 15 destructive nuclear component surveillances per year would be constructed.
- Weapon dismantlement sufficient to achieve the *Moscow Treaty*-accountable stockpile level of 1,700–2,200 operationally deployed strategic nuclear weapons is assumed to occur at Pantex in existing facilities. Because it is likely that further stockpile reductions and associated weapon dismantlements would occur during the operating life of the CNPC, a baseline dismantlement capacity of 400 units per year in five-day, single shift operations is assumed.
- The future U.S. nuclear weapons stockpile is assumed to consist of the same number of weapon types as exist today. The U.S. national security and political leadership are currently considering the authorization of a new weapon type, the RRW, to replace over the next several decades the weapon types in the existing nuclear weapons stockpile. Because a multi-decade series of decisions can not be forecast with confidence at this time, the CNPC would be equipped to allow the future production of both legacy type replacement weapons and the new RRW weapons.
- Plutonium and HEU (together referred to as SNM) would be stored at the CNPC to support future NNSA needs.

Required CNPC Capabilities

- The CNPC would include capabilities for HEU processing and weapon component production as currently performed at Y-12, and plutonium processing and weapon component production as currently performed on a limited capacity basis at LANL. In addition, R&D in support of LANL and LLNL programs requiring the use of Category I or II quantities of SNM would be performed at the CNPC.
- In addition, the CNPC would include facilities for the assembly/disassembly (A/D) mission currently performed at the Pantex Plant. In all cases, the HE processing and fabrication mission is assumed to be an integral part of the weapons A/D mission. As explained in Section 3.5.2, there is an option to separate the weapon A/D mission to allow decision-makers to consider an alternative that locates the nuclear production facilities portion of the CNPC at a different site than the weapons A/D mission.
- Fabrication, inspection, and assembly equipment at the CNPC must support the fabrication of new RRW weapons or replacement legacy weapons. In general, the ability

to produce legacy weapons would also provide RRW production capability. RRW concepts use fewer hazardous materials (than found in most legacy weapons) and require production tolerances within the range of those required for legacy weapons production.

- The assembly of plutonium and HEU nuclear weapons components also requires the production of several unique nonnuclear components. For plutonium components, it is assumed that the stainless steel and other unique metallic parts would be fabricated at or procured by Kansas City Plant (KCP). Legacy weapon plutonium components also require the production of beryllium components. It is assumed that the limited beryllium component production capability at LANL would be sufficient to support any required legacy plutonium component production.
- For HEU secondaries, it is assumed that non-nuclear components currently produced at Y-12 would be produced at the CNPC.
- The CNPC would be designed to provide best reasonably achievable levels of security to protect SNM and complete nuclear weapons. Current classified 2005 Design Basis Threat requirements from NNSA are to be used for the CNPC design. Trade studies would be performed to seek to balance worker safety, security enhancements, and costs for the CNPC. The siting of the CNPC facilities above or below ground is a major example of such a trade study. For initial planning purposes, it is assumed that CNPC facilities would be constructed above ground.
- The CNPC would be designed to have a useful operating life of at least 50 years without major facility renovation beyond normal preventive and corrective maintenance.
- The CNPC would be designed and operated to meet all existing applicable federal, state, and local laws and regulations.

CNPC Facility and Siting Requirements

- The CNPC would be considered for location at one of the following NNSA sites: Los Alamos, Pantex, Nevada Text Site (NTS), Savannah River Site (SRS), and Y-12. Should a site not have adequate space for the full CNPC mission, an option that locates only the plutonium and HEU missions at the site would be evaluated, with the weapons A/D mission remaining at Pantex or relocated to the NTS.
- Beneficial use would be sought from existing and planned assets and capabilities at each site that are expected to have a reasonable remaining useful life at the time of CNPC occupancy. For example, the new HEUMF being constructed at Y-12 is assumed to provide storage for planned inventories of DOE and NNSA highly enriched uranium (HEU) at least until the CNPC is operational. Should the CNPC be constructed at Y-12, the HEUMF would continue to support DOE and NNSA needs, and the Y-12-specific CNPC design would not require new HEU storage facilities.
- A modular arrangement of facilities (campus) is assumed for the CCE options rather than separate operational wings of a single large facility under one roof. The facilities making up the CCE campus would be configured so that they can be constructed sequentially. A single building to house the CCE functions was not considered to be reasonable due to

the need to bring facilities online in sequence and the fundamental differences in uranium, plutonium, and A/D operations.[3] The assumed schedule for the CCE facilities is:

Facility	Start Detailed Facility Design	Begin Operations
CUC	2009	2018
CPC	2012	2022
A/D/HE Center	2015	2025

- It is assumed that facilities at Y-12 and Pantex, whose missions would be included in the CCE alternative, would be brought to a safe shutdown condition as soon as possible if these sites were not selected for a CCE.
- A CNPC or CNC would consist of a central area that includes all operations involving Category I/II quantities of SNM that would be surrounded by a PIDAS. A buffer area would provide unobstructed view of the area surrounding the PIDAS. Support facilities requiring lower levels of security protection would be outside the PIDAS. The land requirements for operation of a CNPC and CNC are shown in Tables A.3-1 and A.3-2 respectively.

Table A.3-1—Land Requirements to Operate a CNPC*

Operation (acres)	Total Area: 445 Acres**	
	PIDAS	Non-PIDAS
	Total: 235 • CPC: 40 • CUC: 15 • A/D/Pu Storage: 180	**Total: 210** • Non-SNM component production: 20 • Administrative Support: 70 • Explosives Area: 120

*Total land area for CNPC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.
** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

Table A.3-2—Land Requirements to Operate a CNC*

Operation (acres)	Total Area: 145**	
	PIDAS	Non-PIDAS
	Total: 55 • CPC: 40 • CUC: 15	**Total: 90** • Non-SNM component production: 20 • Administrative Support: 70

*Total land area for CNC at Y-12 would be reduced by approximately 27 acres due to existing uranium production facilities.
** Includes a buffer area that would provide unobstructed view of the area surrounding the PIDAS.

A generic layout of the CNPC is shown in Figure A.3-1.

[3] The facilities that would constitute a CCE would be separate buildings in a campus because they have different safety and operational requirements, and it would not be technically feasible to put them in a single large facility without having separate systems for the operation of the three facilities and other physical features (blast wall separation, etc.) to keep them separate. They would be built in sequence because they are very complex facilities and the realities of construction logistics, cash flow, and start-up management would not support a single facility. Building them in sequence reduces the construction management risk and allows lessons learned from one to benefit the others. The CUC would be first because the existing uranium facilities at Y-12 are very old. The CPC would be built second because the LANL facilities can handle the immediate need for pits. The weapons A/D/HE facilities would be last because there is the least programmatic urgency for them.

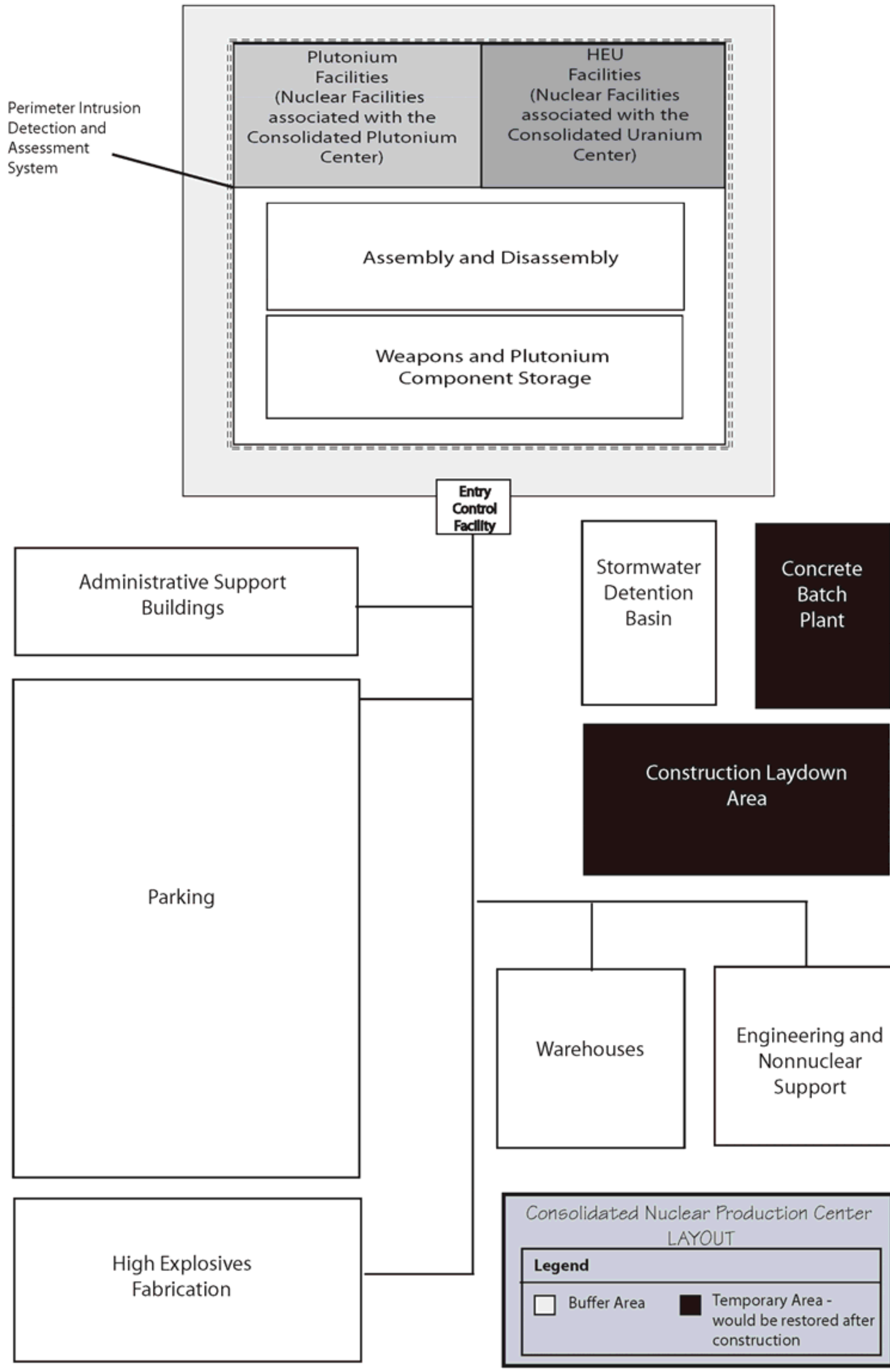


Figure A.3-1—Generic Layout of the CNPC

A.3.1 Consolidated Uranium Center (CUC)

The CUC would primarily be made up of a nuclear facility[4] located within the PIDAS, and non-nuclear support facilities outside the PIDAS. The nuclear facility would process HEU, produce nuclear weapon secondary components, and provide the capability to perform HEU R&D in support of Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). The nuclear facility would also store HEU. The non-nuclear facilities would contain the necessary and support operations associated with additional weapon materials, such as depleted uranium (DU) alloys; lithium hydride and lithium deuteride; stainless steel, and other general manufacturing materials.

The CUC would be constructed over a six-year period, beginning in approximately 2011, with completion by approximately 2016, and operations beginning by approximately 2018. The design service life of the CUC would be 50 years.

This section presents major differences between the UPF described in Section 3.4.2 and the CUC that could be built at sites other than Y-12. The major difference involves the addition of HEU storage and the non-nuclear support facilities outside the PIDAS. Construction of the CUC at sites other than Y-12 would require approximately 50 acres of land.

The nuclear portion of the CUC would contain approximately 500,000 square feet in one building. Of this, storage would account for approximately 100,000 square feet, and would be used for long-term storage of Categories I/II HEU. A capacity to store approximately 10,500 cans and 10,500 drums (55-gallon equivalents) of HEU, a surge capacity area for an additional 3,000 drums, and a storage area for material currently under international safeguards would be provided. The non-nuclear support facilities outside the PIDAS would contain approximately 150,000 square feet.

The CUC would provide secure docking for safeguard transports (SGTs) to ensure the secure, safe transfer of secondaries and other materials containing HEU. The shipping and receiving docks at the CUC would accommodate the simultaneous loading and unloading of three Safeguards Transporters (SGTs) or Safe Secure Trailers (SSTs). The main operational steps that would be involved in handling containers with HEU materials are presented below:

- SGT arrives at the loading dock.
- Shipping containers are offloaded and moved to the nondestructive assay (NDA) and recontainerization area.
- A transfer check is performed.
- Containers undergo NDA.
- HEU materials are placed in new containers if required.
- Each container entered into the computerized tracking system and is assigned a rack location.

[4] For purposes of this SPEIS, this nuclear facility will be referred to as the Uranium Processing Facility (UPF), as generally described in Section 3.4.2. However, the UPF at Y-12 would not require HEU storage within the UPF, as an existing HEU Materials Facility (HEUMF) exists at that site. The UPF for all other site alternatives would include HEU storage integral to the UPF. The UPF described in this section includes such integral HEU storage.

- Each container is moved by forklift to its assigned location in the storage area.
- Each container is connected to the automated inventory system

A.3.2 Assembly/Disassembly/High Explosives Center (A/D/HE Center)

The A/D/HE Center would carry out the following major missions:

- Assemble warheads;
- Dismantle weapons that are surplus to the strategic stockpile and sanitize or dispose of components from dismantled weapons;
- Develop and fabricate explosive components; and
- Conduct surveillance related to certifying weapon safety and reliability.

The A/D/HE Center would be made up nuclear facilities located within the PIDAS and non-nuclear facilities outside the PIDAS. In support of this mission, approximately 300 acres would be required for the A/D/HE Center. The nuclear facilities would contain the cells and bays in which maintenance, modification, and A/D operations are conducted. The facilities would be designed to mitigate the effects of the unlikely accidental detonation of the weapon’s explosive components. Bays differ from cells in that bays are designed to vent an explosion to the atmosphere while protecting adjacent facilities from the blast, while cells are designed to filter the explosion products while also protecting the adjacent facilities from the blast.

An area of 180 acres would be provided in the PIDAS for the weapons A/D facilities and the associated weapons and plutonium component storage. Located outside the PIDAS area would be a buffer zone and non-nuclear facilities for HE fabrication, administrative support, and disposal of explosive materials. This area would be approximately 120 acres. The A/D/HE Center would be constructed over a six-year period, beginning in approximately 2021, with completion by approximately 2026, and operations beginning by approximately 2027. The design service life of the A/D/HE Center would be 50 years.

A.3.2.1 *Operations Conducted at the A/D/HE Center*

Assembly. Weapons assembly requires written, prescribed steps to combine separate parts to form a new weapon. Complete weapons assembly would be accomplished in the following stages:

- Physics package assembly;
- Mechanical and electronic components assembly; and
- Final package or ultimate user package assembly.

The physics package is a subassembly combining HE components (to be produced at the A/D/HE Center) and nuclear components (to be manufactured at the CPC and Consolidated Uranium Center [CUC]) within a protective shell. Physics package assembly entails bonding or mating the main charge subassemblies to a nuclear pit and then inserting this subassembly into a case along with other components. Mechanical and electronic components assembly entails placing the physics package in a warhead case and then installing the components for the arming, fusing, and firing systems; the neutron generator; and the gas transfer system. The final package assembly involves installing additional components and packaging the weapon for shipment.

Dismantlement. Dismantlement consists of disassembly and disposal or sanitization of weapon components. The dismantlement process begins with the arrival of the weapon at the A/D/HE Center. Disassembly would include the following:

- Weapons staging, which includes inspection and verification after receipt from DoD;
- A variety of specialty operations (e.g., X-ray examinations, leak testing, coding, packaging, painting, verification, etc.) in special purpose bays;
- Mechanical disassembly operations in bays;
- Nuclear disassembly operations in cells;
- Demilitarization and sanitization of weapon components, which includes grinding, crushing, and open-air burning;
- Packaging and shipping HEU to the CUC and tritium components to the SRS;
- Packaging and shipping pits to the CPC; and
- Segregation of waste products into nonhazardous, hazardous, low-level radioactive, and low-level mixed waste categories.

High explosives fabrication. The A/D/HE Center would manufacture the main charge HE and other small explosive components. The fabrication process for explosives involves synthesizing energetic materials (explosives) and then formulating the energetic materials with other materials as appropriate. Some of the energetic materials are manufactured at the plant, while others are procured commercially. The explosive powder is then pressed into the configurations needed and machined for use in nuclear weapons. The products of manufacturing operations are explosive main charges, small explosive components, and other highly specialized explosive materials. Main charge subassemblies are emplaced in the physics package of a nuclear explosive during the weapon assembly process. Various small explosive subassemblies and pellets are produced from explosives, metal or plastic components, electrical components, hardware, assembly materials, and small explosive components that are manufactured offsite.

Surveillance. To maintain the reliability of the Nation's nuclear weapons, a certain number of randomly selected weapons from all active systems would be annually removed from the stockpile and returned to the A/D/HE Center. The weapons are disassembled, tested, and evaluated to ensure the operability of the weapons components. Most testing is done onsite, but tests associated with component aging are performed at other laboratories and production agencies. Some weapons are configured as Joint Test Assemblies (JTAs) and provided to the military for flight testing. Main charge explosive components and SNM are removed from weapons before this testing. Certain components are physically removed from the weapon, assembled into test con-figurations, and subjected to electrical and/or explosives testing. Components not destroyed during the testing process can be recycled and made available for use in other weapon system assemblies.

Security at the A/D/HE Center. Security at the A/D/HE Center would be charged with protecting plant personnel, facilities, materials, and information from intrusion. Protective forces guard against any events that may cause adverse impacts on national security, the environment or the health and safety of the public or employees. Special response security team members prepare for any situation that may arise. Specially equipped and trained, these individuals face a range of events that may develop as a result of the constantly changing world situation or local events. State-of-the-art technologies would augment security forces to provide early detection, warning and deterrence.

A.4 A/D/HE CENTER AT NTS

At NTS, the A/D/HE Center would make use of the existing capabilities at NTS such that construction requirements would be reduced compared to the generic A/D/HE Center described above. The A/D/HE Center at NTS would maximize use of existing facilities at the Device Assembly Facility (DAF), the underground complex of tunnels at U1a, the Big Explosive Experiment Facility (BEEF), the Explosives Ordnance Disposal Unit (EODU), existing NTS site infra-structure, and the support areas of Mercury, the Control Point, and Area 6 construction (Figure A.4-1). By utilizing each of these unique existing assets, the need for additional construction is minimized and the existing benefits of each site are maximized.

The existing DAF would form the cornerstone of the A/D/HE Center at NTS. The NTS alternative would utilize the DAF for disassembly operations. DAF can fully support disassembly operations and continue to support the existing criticality experiment missions that were recently added to the DAF. Disassembly operations in the DAF would not require additional construction within the PIDAS or additions to the existing PIDAS. In the non-PIDAS area of the DAF and outside the buffer zones, an administrative facility and parking area would be constructed to support the increased personnel processing requirement for disassembly. The available space in DAF consists of the following:

- 3 Assembly cells (8,510 square feet);
- 2 Radiography bays (6,351 square feet);
- 1 Downdraft table bay (1,681 square feet);
- 1 Assembly bay (1,681 square feet);
- 2 Bunkers (1,872 square feet);
- 2 limited use vaults (180 square feet);
- 1 High bay (1,790 square feet);
- 1 Bunker (936 square feet);
- 1 MC&A measurement building (2,142 square feet);
- 1 shipping/receive bay (2,012 square feet);
- Administrative space (3,700 square feet);
- 1 Glovebox bay (1,681 square feet); and
- Corridors (20,000 square feet).

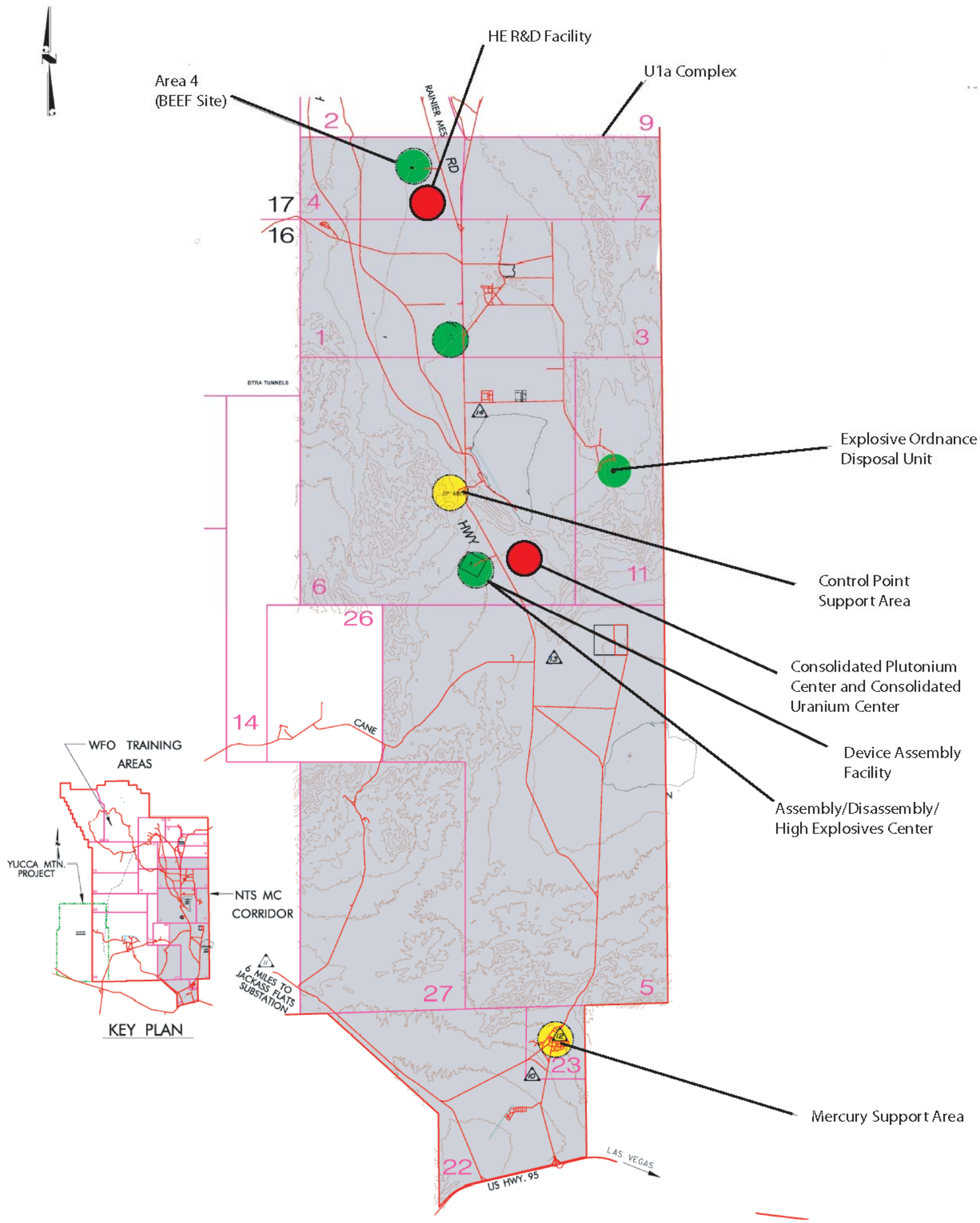


Figure A.4-1—NTS CNPC Reference Location

The remaining operations of assembly, longer-term storage for nuclear and non-nuclear components that are generated by DAF disassembly activities, weapon surveillance, and strategic reserve storage of plutonium would be located 900 feet underground in the tunnel complex at U1a. This alternative would include construction of new tunnels and alcoves in accordance with nuclear explosive requirements for assembly and storage operations. At the U1a Complex, access to the tunnel network is limited to two vertical access/egress shafts that would require construction of a small PIDAS around the surface footprint of each shaft.

A.5 CONSOLIDATION OF CATEGORY I/II SNM

A.5.1 No Action Alternative

A.5.1.1 *Lawrence Livermore National Laboratory*

LLNL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and isotope separation. Based on facility design and operation, LLNL establishes administrative limits for fissile, special use, radioactive, and sealed materials. An administrative limit is the total amount of certain materials allowed in a specific building at LLNL. These limits are used in determining potential risks associated with accidents. Actual inventories may be classified. Nonwaste management facilities at LLNL authorized to have Category I/II SNM quantities are Building 332, Building 334, and Building 239. However, only Building 332 stores such material, and both Building 334 and Building 239 have no materials stored in them. As such, only Building 332 is germane to the discussion below. With respect to waste management facilities with Category I/II SNM, the Decontamination and Waste Treatment Facility (DWTF) (Figure A.5.1-1) manages TRU waste that would be shipped to WIPP.

The Building 332 Plutonium Facility is part of the Superblock, a protected area located in the southwest quadrant of the Livermore Site (see Figure A.5.1-2). This building has a total area of 104,687 gross square feet, including radioactive materials laboratories, mechanical shops, change rooms, storage vaults, a fan loft, basement, equipment rooms, and offices. There are currently 24 laboratories in which radioactive materials can be handled within the radioactive material areas (RMAs) of the facility (LLNL 2005).

The mission of Building 332 includes R&D in the physical, chemical, and metallurgical properties of plutonium and uranium isotopes, compounds and alloys, and certain actinide elements. Operations within Building 332 include melting, casting, welding, and machining; developing alloys and heat treating; testing torsion, tensile, and compression; measuring density and heat capacity; machining, inspecting, and testing components; using chemical processes to purify, separate, or convert actinide materials; pressure testing and gas filling operations; and assembling components. Chemical analyses can also be conducted on gram-sized samples in support of these activities.

The Materials Management Division is responsible for all shipments of radioactive and other controlled materials to and from Building 332, as well as movement within the building. This division also controls storage of these materials in the building vaults. The vaults are equipped to safely store fissile, radioactive, and certain other SNM required for programmatic operations. Criticality safety controls for the vaults include specially designed storage racks and containers to control the spacing of stored fissile materials and mass limits for each storage location or rack cell within a storage vault. LLNL criticality safety controls also specify mass limits for each workstation (LLNL 2005). Legacy and new TRU waste is temporarily stored in the basement, and the individual waste drums are scanned by a segmented gamma scanner to verify radionuclide and curie content. Although actual quantities of Category I/II SNM in Building 332 are classified, the administrative limits are as follows:

Plutonium	1,400 kg
Enriched uranium	500 kg

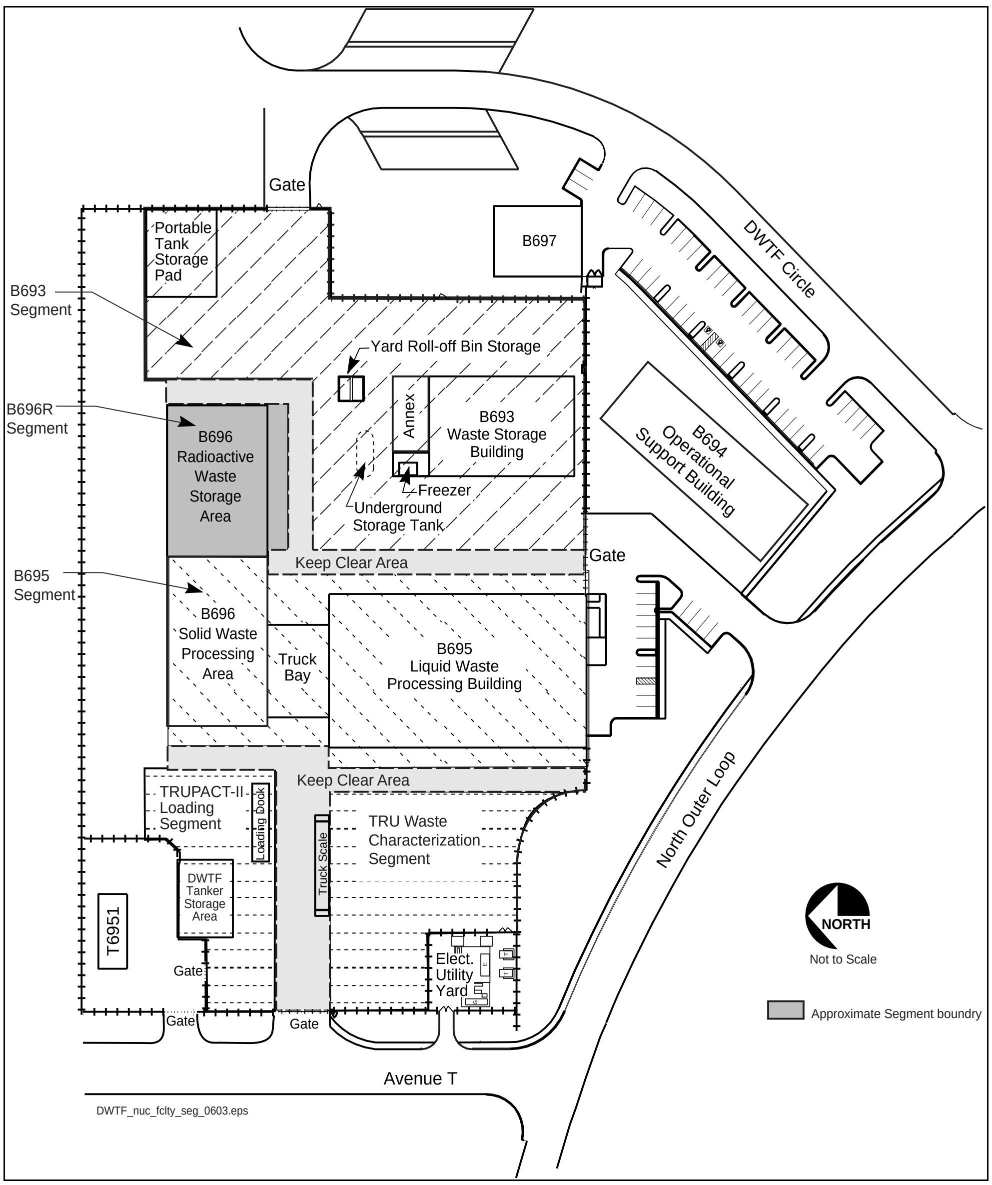


Figure A.5.1-1—Decontamination and Waste Treatment Facility at LLNL

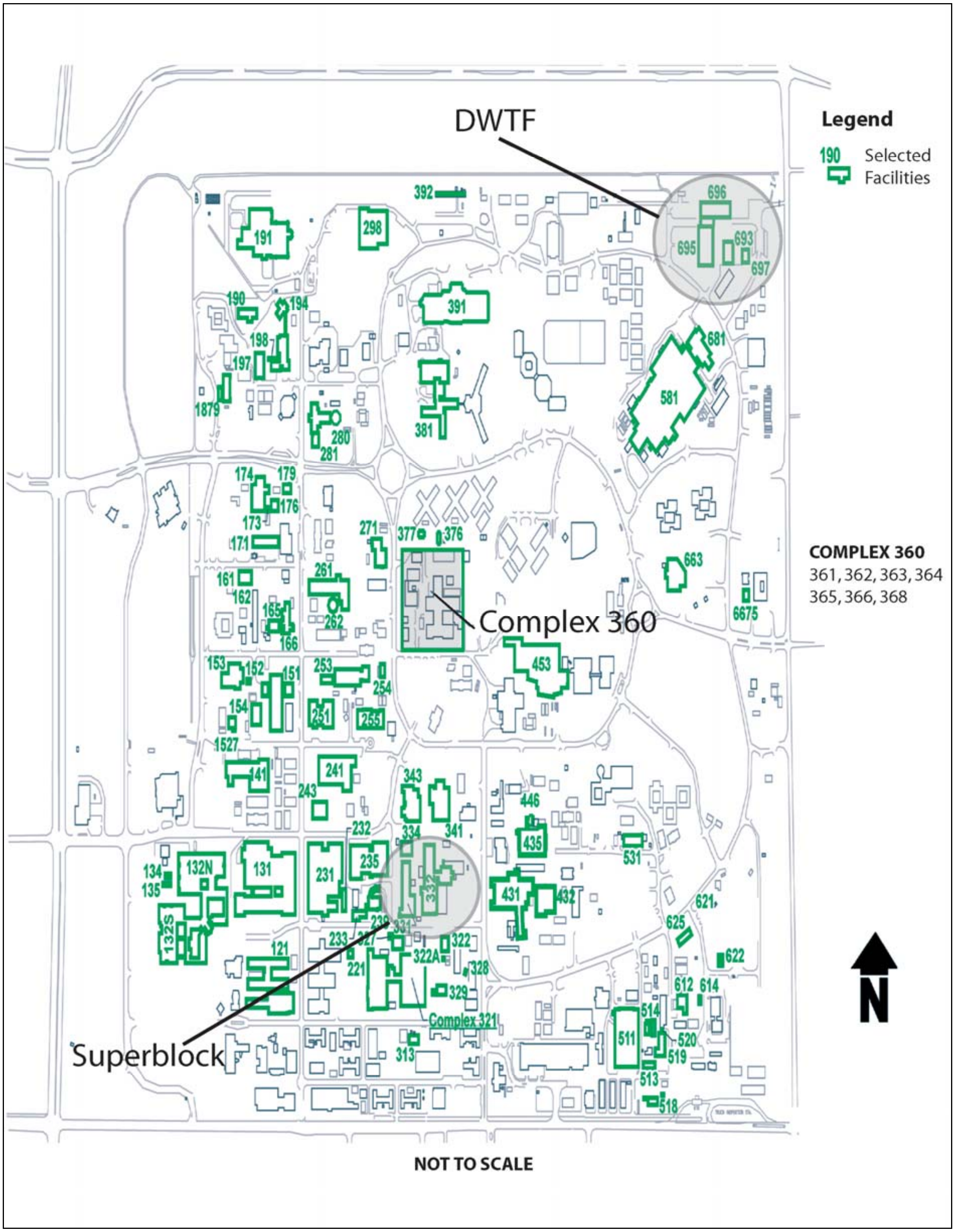


Figure A.5.1-2—Location of Building 332 and the DWTF at LLNL

In 1996, construction of a new consolidated waste treatment facility, the DWTF, began in the northwest corner of the Livermore Site (see Figure A.5.1-1). The DWTF construction has been completed and currently consists of Buildings 6951, 693, 694, 695, 696, and 697 and associated yard areas. The DWTF replaces waste management operations in Area 514 and Building 233 and consolidates other waste management activities into one facility (Figure A.5.1-3).

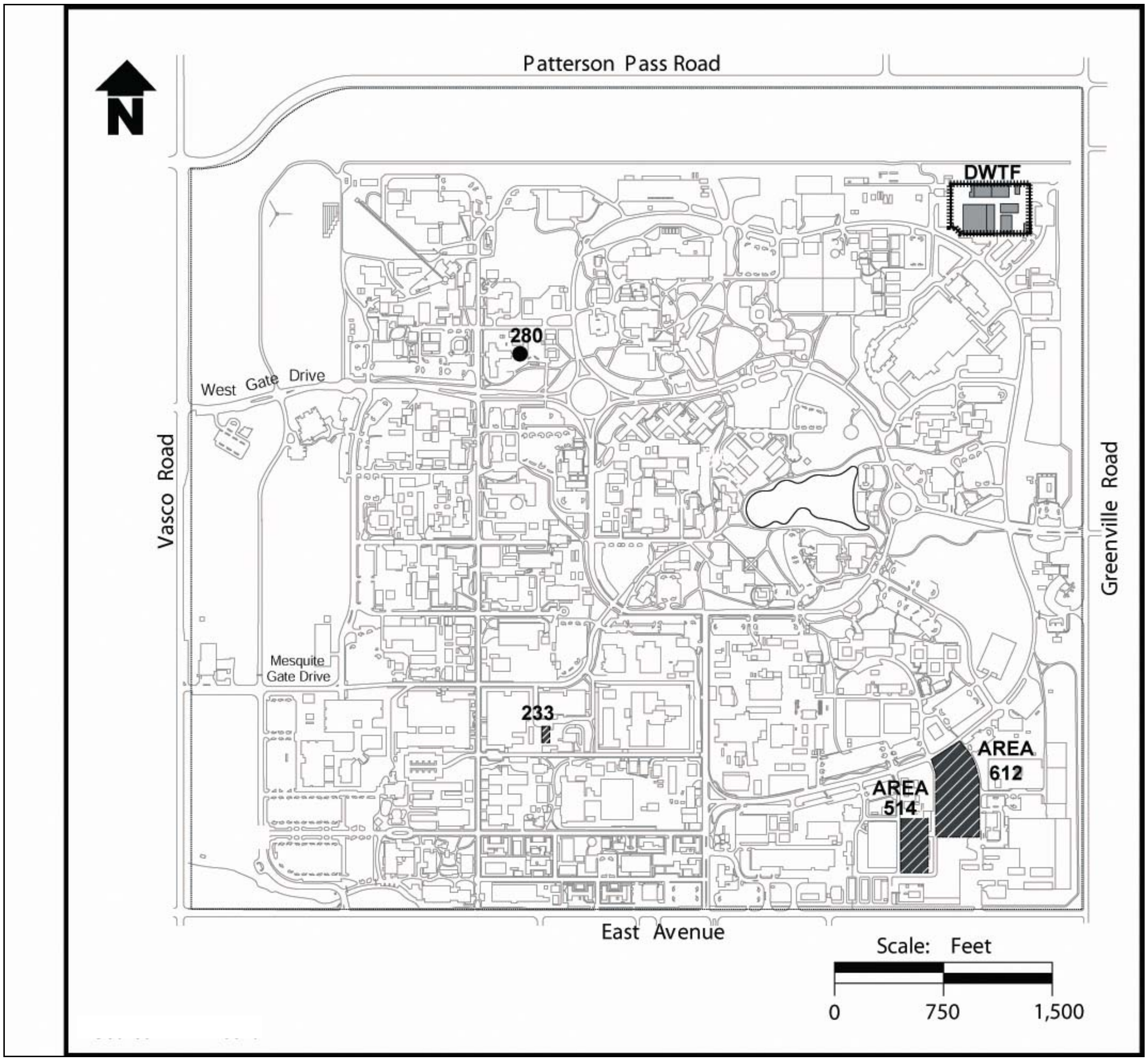


Figure A.5.1-3—Location of Waste Management Areas at LLNL

The DWTF is a hazardous, radioactive, and mixed waste treatment and storage facility located in the northeast corner of the Livermore Site. Hazardous and mixed waste management activities involve five individual facilities: Buildings 693, 694, 695, 696, and 697, and associated yard areas (see Figure A.5.1-3). Building 693 is a container storage unit and activities include waste packaging and storage. Building 695 provides storage and waste treatment capabilities including bulking and blending of wastes into treatment tanks; treating liquid and solid hazardous, mixed, and low-level radioactive wastes; storing; container rinsing; and waste transfer. Building 694 is the operational support facility and Building 697 is a Chemical Exchange Warehouse used for chemical exchange operations. Building 696 provides radioactive waste storage and solid waste receiving and processing capabilities. Building 695 includes a maintenance shop. Areas within the DWTF yard include a rainwater management area, a tanker storage area, a covered truck bay, and truck scales. Yard areas are used by mobile vendors to certify TRU waste and load it for shipment to WIPP.

Building 696R is designed for the storage of solid TRU waste, solid and liquid LLW, and combined waste (i.e., radioactive and California-regulated hazardous waste). Operations in the Building 696R segment include loading, unloading, staging, storage, over packing, LLW sampling, and periodic visual inspections of waste containers. Building 635 also stores TRU waste.

The mission performed in the TRU waste segments is to characterize LLNL TRU waste, repackage it as necessary, and load the waste drums into Transuranic Package Transporter–II (TRUPAC-II) casks for offsite shipment. The waste needs to meet both the DOT shipping requirements and the waste acceptance criteria for the receiving facility, which will be the WIPP. The amount of TRU managed at DWTF is approximately 110 cubic meters per year (LLNL 2005).

A.5.1.2 *Los Alamos National Laboratory*

LANL uses radioactive materials in a wide variety of operations including scientific and weapons R&D, diagnostic research, research on the properties of materials, and plutonium pit production. The technical area (TA)-55 Plutonium Facility Complex (TA-55 Complex) encompasses about 40 acres and is located about one mile southeast of TA-3 (Figure A.5.1-4). The Plutonium Facility Complex has the capability to process and perform research on actinide materials, although plutonium is the principal actinide used in the facility. Most of TA-55 is situated inside a restricted area surrounded by a double security fence. The main complex has five connected buildings: the Administration Building, Support Office Building, Support Building, Plutonium Facility, and Warehouse.

The Plutonium Facility, a two-story laboratory of approximately 151,000 square feet, is the major R&D facility in the complex (Figure A.5.1-5). The Plutonium Facility provides storage, shipping, and receiving activities for the majority of the LANL SNM inventory, mainly plutonium. This includes temporary storage of Security Category I/II materials removed from TA-18 in support of TA-18 closure until these materials are shipped to NTS and other DOE sites. All materials from TA-18 are scheduled to be moved to final disposition locations by March 2008. In addition, sealed sources collected under DOE’s Off-Site Source Recovery Project are stored at TA-55 or sent to other LANL locations for storage pending final disposition. When appropriate, mixed-oxide fuel materials stored at TA-55 would be transported to other DOE sites. TA-55 provides interim storage of up to 7.3 tons of the LANL SNM inventory, mainly plutonium.

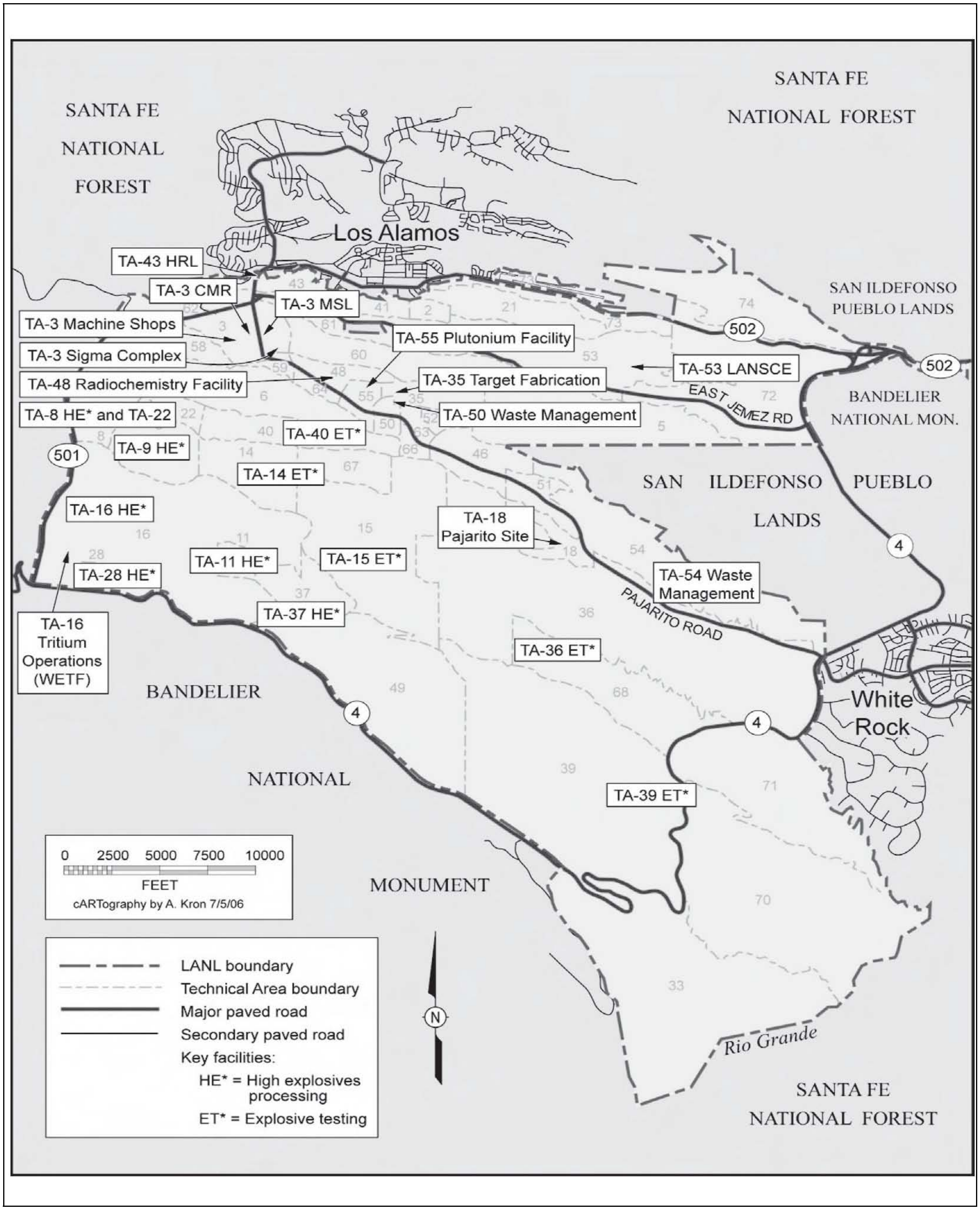


Figure A.5.1-4—Major Technical Areas at LANL, including TA-55 Plutonium Facility Complex

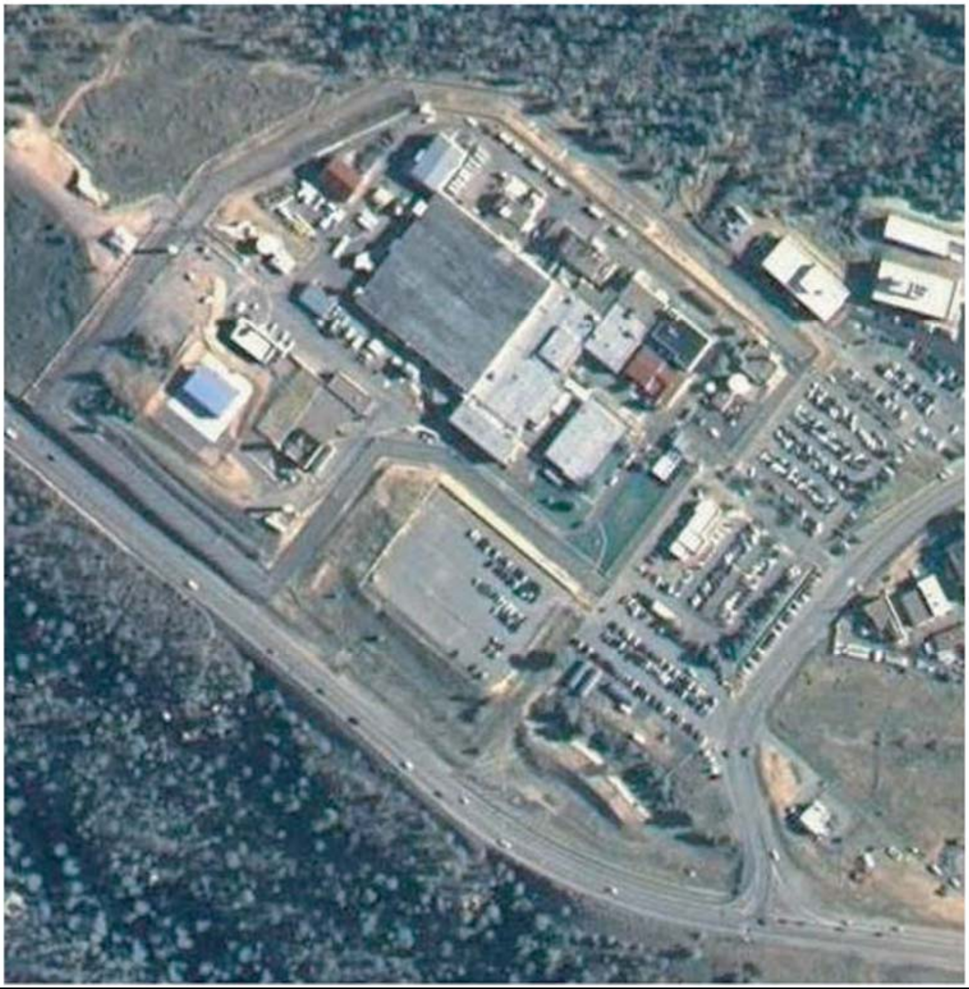


Figure A.5.1-5—Plutonium Facility at TA-55

PROJECT-SPECIFIC ALTERNATIVES

A.6 HIGH EXPLOSIVES R&D

A.6.1 No Action Alternative

This section describes the HE R&D facilities and missions currently conducted at weapons complex sites.

A.6.1.1 *Lawrence Livermore National Laboratory*

HE R&D at LLNL is carried out primarily in two facilities—the HEAF at the main Livermore site, and the Chemistry, Materials and Life Sciences Facility at Site 300. A basic description of each of these facilities is given below.

The High Explosives Application Facility (HEAF) is a full-spectrum R&D facility which performs the following missions:

- Explosive characterization and lab-scale development;
- Performance and safety testing; and
- Modeling and simulation of explosive properties and reactions.

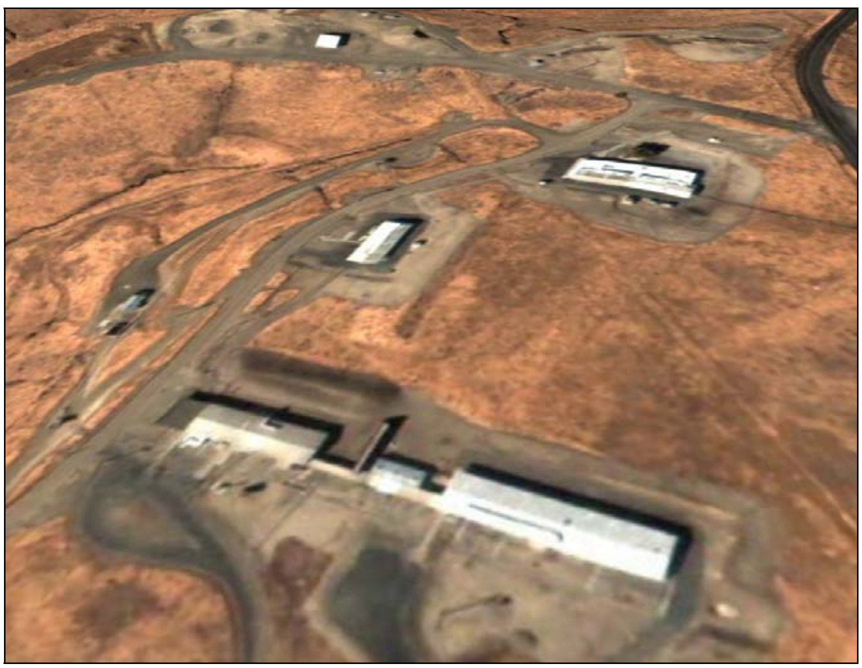
The HEAF includes laboratory areas approved for handling explosives in quantities up to 10 kilograms, and office space for the research and support staff. The net usable area of the facility is approximately 65,000 square feet. An aerial view of the HEAF is shown in Figure A.6.1-1.

Note: The facility section at the bottom of the image is the office area; the area behind that houses the laboratory areas including firing tanks

Figure A.6.1-1—The LLNL HEAF

The Chemistry, Materials and Life Sciences Facility at Site 300 provides the capability for larger scale synthesis and formulation, HE R&D part fabrication (e.g. pressing radiography, machining and assembly), and explosives waste packaging, storage and treatment. These capabilities are provided by the Chemistry Area, the Process Area, the Explosive Waste Storage Facility, and the Explosive Waste Treatment Facility. The net usable space is approximately 35,000 square feet. Figures A.6.1-2 and A.6.1-3 show the Chemistry, Materials and Life Sciences Facility at Site 300.

Figure A.6.1-2—Chemistry Area at Site 300, providing scale up of formulation and synthesis of HE



Note: Shown are B.806 (foreground), B807 directly behind B806 to the left, B805 behind B806 to the right, and the EWSF at the top of the photo

Figure A.6.1-3—A portion of the Process Area at Site 300

There are approximately 175 scientists, engineers, and technicians associated with the HE R&D mission at LLNL.

A.6.1.2 *Los Alamos National Laboratory*

LANL conducts HE R&D activities in nine technical areas, as discussed below. While the LANL HE R&D facilities share some common spaces with the hydrodynamic program, for purposes of this SPEIS, the current HE R&D activities at LANL are considered to be housed in approximately 250,000 square feet, managed as three facilities (HE Science, HE Fabrication, and HE Firing Sites) in 31 buildings (>1000 square feet), which includes magazines and firing points. Major TAs with HE R&D facilities are discussed below and shown on Figure A.6.1-4.

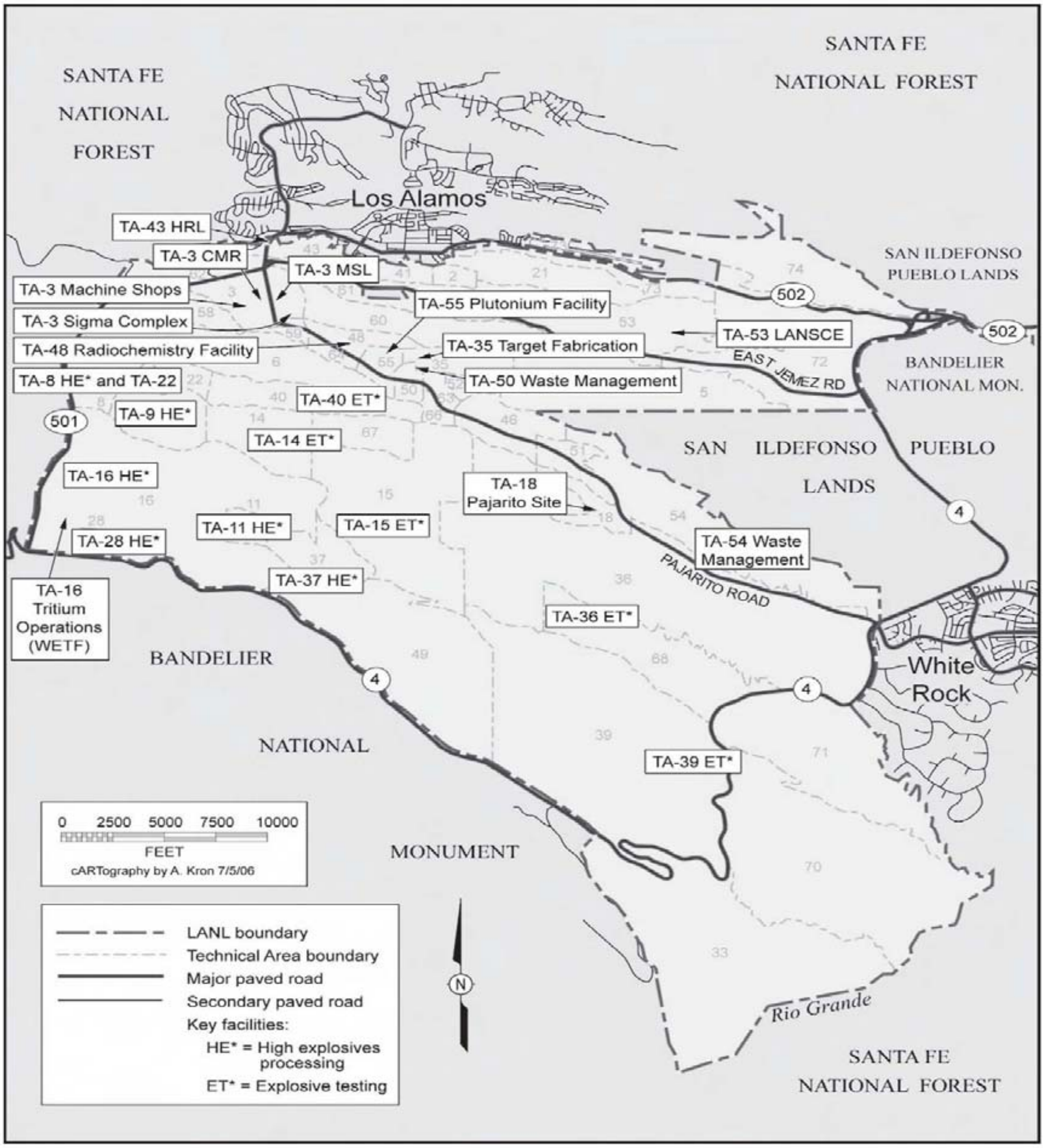


Figure A.6.1-4—LANL Technical Areas

TA-9 This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this site, and new organic compounds are investigated for possible use as explosives. Storage and stability problems are also studied.

TA-14 Located in the northwestern part of LANL, this TA is one of 14 firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning. Tests are conducted on explosives charges to investigate fragmentation impact, explosives sensitivity, and thermal responses of new high explosives. This site is currently permitted to treat waste through open detonation or open burning under the *RCRA*.

TA-16 Fabrication of precision explosive assemblies, from powder pressing to machining and inspection, occurs at TA-16 to support HE R&D experimentation. LANL owns and maintains the only capability for fabrication of plane wave lenses used throughout the nation, at this facility.

TA-22 This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. R&D and fabrication of high-energy detonators and related devices are conducted at this facility.

TA-36 TA-36 is in a remotely located area in the eastern portion of LANL that is fenced and patrolled. It has two active firing sites that support the HE R&D mission (it has two other firing sites that support the hydrotesting mission). The sites are used for a wide variety of nonnuclear ordnance tests pertaining to warhead designs, armor and armor-defeating mechanisms, explosive vulnerability to projectile and shaped-charge attack, warhead lethality, and determining the effects of shock waves on explosives and propellants. Diagnostics include optical photography, multiple beam laser velocimetry, high speed electrical signal recording, and pulsed X-ray techniques.

TA-39 TA-39 is located at the bottom of Ancho Canyon. The behavior of nonnuclear weapons is studied here, primarily by photographic techniques. Also studied are the various phenomenological aspects of explosives, interactions of explosives, explosions involving other materials, shock wave physics, equation-of-state measurements, and pulsed-power systems design and experimentation.

TA-40 TA-40, centrally located within LANL, is used for studies of explosive initiation, detonation, and shock wave response of other materials related to weapon systems. Both fundamental and applied research investigating phenomena associated with the physics of high explosives and shock-induced chemical reactions are conducted. In addition, surveillance and qualification studies of War Reserve (WR) detonators are conducted.

TA-46 TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL's basic research sites. Activities have focused on applied photochemistry operations and have included development of technologies for laser isotope separation and laser enhancement of chemical processes. Current operations include studies of the response of small quantities of explosives to thermal and mechanical stimuli, with the experiments housed in boomboxes.

TA 53 At Area C of LANSCE, located at TA-53, LANL has developed Proton Radiography, a unique national resource. Proton radiography (800 megaelectron volts [MeV]) has the ability to capture a sequence of images, creating a movie of an explosive event (up to 33 frames, currently). Protons have approximately 100 micrometers spatial resolution for HE systems, with high contrast over a wide range of areal densities. Protons are different from X-rays in that there is no background or detector scatter, so quantitative density measurements are possible. Proton radiography shots are currently limited to 10 pounds Trinitrotoluene (TNT) equivalent in a containment vessel.

The general HE R&D activities at LANL can be broken down into the following missions:

- HE synthesis and formulation R&D;
- Physics and engineering performance, and safety models;
- Thermal response of HE;
- HE characterization;
- Characterization of HE-driven materials;
- Detonator technology R&D;
- HE test fire capabilities; and
- Military and commercial applications of HE.

A.6.1.3 *Pantex Plant*

The Pantex Plant researches the physical and chemical characteristics of the parts used in nuclear weapons. Highly specialized explosive main charges and initiation systems are required for a weapon to produce a nuclear explosion. Research at Pantex includes the use of insensitive HE for increased safety as well as refinement of HE manufacturing methods and safety procedures. Pantex performs HE synthesis, formulation, machining, extrusion, testing, process development, and analytical operations in performing its HE research and development and production missions. These operations are performed in Zone 11 or Zone 12 using HE materials stored in Zone 4 East remote firing sites (see Figure A.6.1-5). HE R&D activities and HE production mission work at Pantex occur in common facilities and work areas. As a result, R&D and production missions are not segregated in terms of facilities, infrastructure or work force. In general, less than 10 percent of the annual HE-related budget at Pantex is associated with HE R&D activities.

R&D activities at Pantex, not related specifically to production process improvement, primarily involve stockpile-related surveillance and periodic reimbursable work typically with technical direction from the national laboratories. This work is traditionally concentrated within the testing mission categories. There are currently no Pantex facilities dedicated entirely to HE R&D work. By conducting HE R&D efforts in the production facilities, NNSA is able to leverage the infrastructure investment to accomplish both objectives.

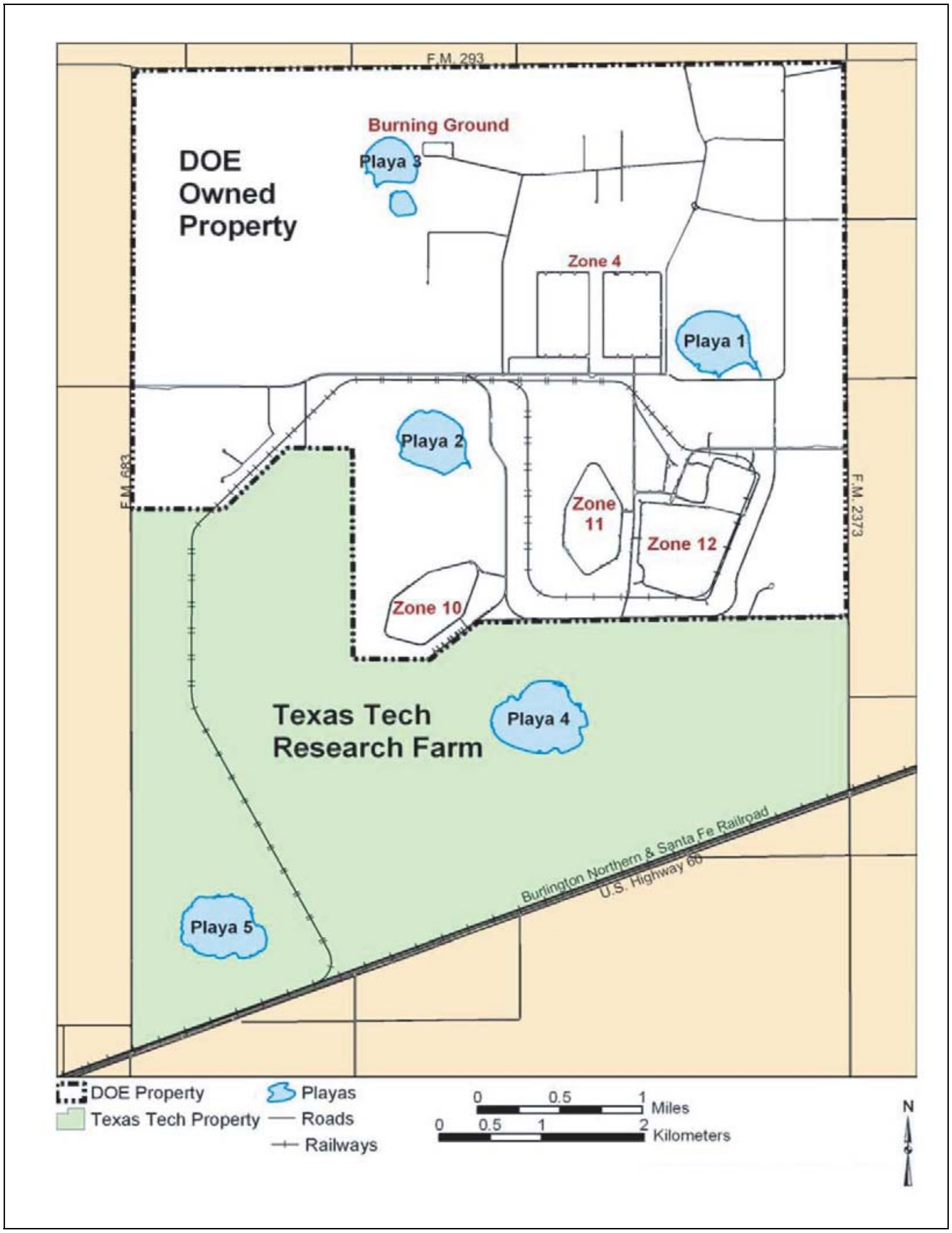


Figure A.6.1-5—Relevant Zones at Pantex for HE R&D

A.6.1.4 *Sandia National Laboratories/New Mexico (SNL/NM)*

SNL/NM has mission responsibility for the nonnuclear components, which comprise approximately 95 percent of the components in a weapons system, and for assuring the safety and reliability of the complete, integrated nuclear weapon system. The major SNL/NM facilities and labs that conduct HE R&D are described below.

The Explosive Component Facility (ECF), shown in Figure A.6.1-6, was built specifically to conduct the SNL/NM work on explosive components. The ECF includes over 100,000 square feet of laboratories, diagnostic centers and performance facilities for the research and development of advanced explosive technology and sits on 22 acres on Tech Area II (see Figure A.6.1-7). Unique facility features include explosives labs qualified for all types of explosives, HE chambers and firing pads, explosive component disassembly area, explosives receiving area, and explosives storage. The ECF includes the ability to handle, store, test and model all types of explosive materials, conduct performance testing and material compatibility studies, and surety assessments related to safety and reliability. Approximately 80 people work at the ECF.

Figure A.6.1-6—Explosives Component Facility (ECF); SNL/NM Bldg 905

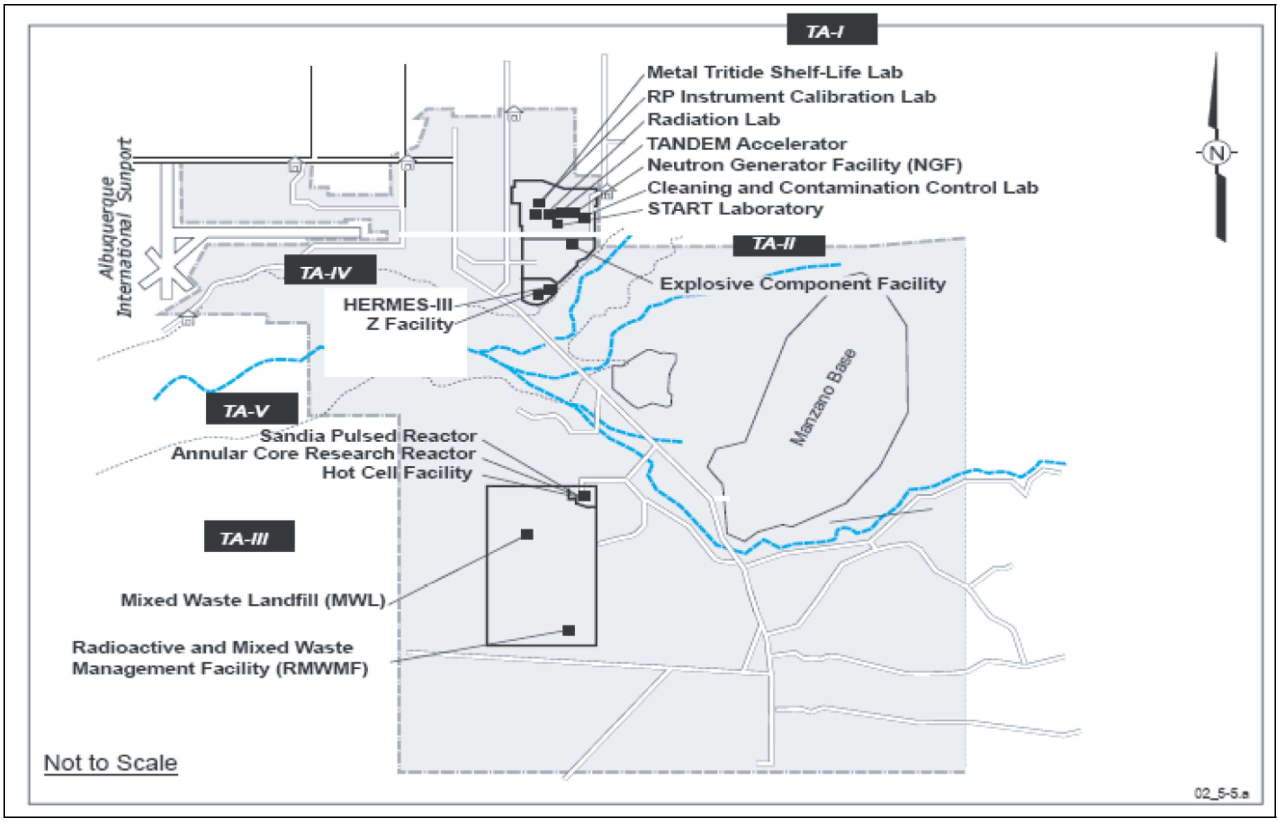


Figure A.6.1-7—SNL/NM Technical Areas

The Terminal Ballistics Facility (TBF) includes a 1,000 square-foot indoor and a 100-acre outdoor firing range that accommodate live testing and firing of guns ranging in size from 0.17 caliber to 8-inch. The facility retains the world's fastest launch capability for masses of 300–2000 grams. The site also conducts static firings of solid fuel rocket motors of up to 100,000 pounds thrust. The firing site can accommodate explosive detonation tests up to 50-pound TNT equivalent. Up to 12 people work at the TBF depending upon the test being supported. These staff are part of the approximately 80 people who work at the ECF.

Currently, there are two facility infrastructures used for explosive storage: the “6000 Igloos” and Manzano. Both storage infrastructures and the facilities are owned by Kirtland AFB. The 6000 Igloo storage area has a total of 21,000 square feet and includes 21 facilities (10 of 21 are for classified storage). The Manzano storage area includes 43 facilities, of which 13 are used for explosive storage. Approximately 18 people maintain the storage facilities.

Sandia utilizes facilities in 9930, 9939, 9920 to conduct research, design, development, manufacture and testing of explosive components, explosive systems, and arming and firing system hardware. The department also operates laboratories in Tech Area IV and the Explosives Applications Laboratory (Site 9930) in Coyote Canyon. Approximately 36 people support this mission.

The DETS Complex utilizes facility 9940 and is located on the Coyote Test Field. Current work at the facility involves arming and firing of explosives and the testing of explosive systems components in both terrestrial and aquatic settings. The site can fire up to 50 pounds TNT equivalent. These facilities are used to serve the needs of the Joint Tactical Operations Teams (JTOT) nuclear emergency response program and to meet the energetics technology needs of the DoDSpecial Forces and the Intelligence Community. There are three lines of business: energetics research, emergency response training, and threat assessments. This now includes a firing site on Thunder Range, which is 523 acres and can fire up to 500 pounds TNT equivalent. Staffing at these two sites is approximately 30–60 people.

A.7 TRITIUM R&D

A.7.1 Tritium R&D No Action Alternative

Under the No Action Alternative, NNSA would continue the ongoing tritium mission at current sites. This would entail the following tritium operations at the sites described below.

A.7.1.1 *Lawrence Livermore National Laboratory*

The LLNL Tritium Facility is a Hazard Category 3 (HC-3) nuclear facility supporting a variety of NNSA, DoD, Department of Homeland Security, and work-for-others programs using tritium, plutonium, uranium, and other radionuclides. It is located within the Superblock limited security area (see Figure A.7.1-1) at LLNL's main Livermore site. The primary tritium mission of the LLNL Tritium Facility is NIF target R&D with NIF production target filling to be added in support of the NIF Ignition Campaign beginning in 2009. As a result, per the LLNL SWEIS ROD, LLNL has received NNSA approval to increase its tritium inventory to 35 grams. The facility also hosts Gas Transfer System Research and Development experiments conducted by Sandia National Laboratory/California (SNL/CA) researchers, which is engaged in neutron generator development and provides maintenance and recertification services for the UC-609 Type B tritium shipping package.

Figure A.7.1-1—LLNL Tritium Facility within Superblock

A.7.1.2 *Los Alamos National Laboratory*

The LANL WETF is a Hazard Category 2 nuclear facility located at TA-16, which also is referred to as S-Site. TA-16 is in a remote area with controlled access (that is, a limited security area) (Figure A.7.1-2). The Weapons Engineering Tritium Facility (WETF) is in the early stages of its anticipated operational life of 30–40 years. The WETF mission is to perform tritium R&D in support of LANL's stockpile stewardship mission, primarily the gas transfer system (GTS) design agency (DA) mission. Support of the GTS DA mission requires the flexibility to quickly react to any issue that is discovered in the stockpile. The primary use of tritium in the stockpile is in GTS, which requires that large quantities of tritium be processed and handled. Typical WETF tritium processing activities include: 1) Loading and unloading; 2) Removing tritium decay products and other impurities from gaseous tritium; 3) Mixing tritium with other gases; 4) Analyzing tritium as mixtures; 5) Loading tritium onto various metals and metal alloys; 6) Repackaging tritium and other gases to user specifications; 7) Environmental storage and conditioning of GTS components; 8) Performing various user-defined experiments with tritium; 9) Unloading (depressurizing) containers of tritium; and 10) Functionally testing R&D GTS.

A number of WETF systems support tritium processing, experiments, containment, confinement, gaseous tritium cleanup, analysis, and tritium monitoring. WETF's inventory is limited to a total of 1000 grams of tritium. With some physical modifications to the facility, the current Documented Safety Analysis (DSA) would support a tritium inventory as high as 2,000 grams. A portion of the WETF is dedicated to shipping and receiving tritium, which is usually received from SRS in PV-18 primary containers inside UC-609 DOT Type B containers.

Figure A.7.1-2—Aerial Photo of the WETF

All tritium R&D at LANL is performed by approximately 25 people. The number of programmatic R&D researchers is approximately 10 full-time employee (FTEs), with portions of R&D support people making up the remaining 15 FTEs (performing gas analysis, gas mixing, R&D material preparation, R&D apparatus construction/maintenance, etc.).

A.7.1.3 *Savannah River Site*

The SRS Tritium Facilities consist of six HC-2 facilities and two HC-3 facilities which support the NNSA Stockpile Stewardship missions for tritium target extraction; tritium unloading, purification and enrichment; tritium and nontritium reservoir loading; reservoir reclamation; and GTS surveillance. These are collectively referred to as the "tritium production" missions, although the actual production of new tritium is carried out in a Tennessee Valley Authority reactor, with extraction taking place at SRS in the Tritium Extraction Facility (TEF). The TEF includes two of the HC-2 facilities and became operational in late 2006. This facility was designed for a 40-year service life. Final processing of new tritium gas from TEF, as well as all other tritium gas processing, is carried out in the H-Area New Manufacturing Facility (HANMF). This facility became operational in 1994 and was also designed for a 40 year service life. The Tritium Facility Modernization & Consolidation Project, completed in 2004, significantly expanded the tritium gas processing capabilities in the HANMF and added surveillance capabilities in a new 234-7H facility.

The SRS Tritium Facilities, shown in Figure A.7.1-3, are located adjacent to H-Area near the center of the site and about seven miles from the nearest site boundary. The bounding safety basis tritium inventory for the SRS Tritium Facilities is 75,520 grams. All tritium gas processing is done within secondary containment gloveboxes or modules which have either nitrogen or argon atmospheres. The glovebox and module atmospheres are continuously recirculated through stripper systems to recover any tritium which may leak out of piping or components. All gas streams released to the environment are processed through a recovery system to reduce tritium levels to as low as reasonable achievable.

Figure A.7.1-3—Aerial Photo of SRS Tritium Facilities

A.7.1.4 *Sandia National Laboratories/New Mexico (SNL/NM)*

Tritium Operations at SNL/NM are primarily associated with the Neutron Generator Production Facility (NGPF) (Figure A.7.1-4). The primary responsibility of the NGPF is to produce and manufacture neutron generators, which fuse deuterium and tritium to produce neutrons used to initiate the fission reaction in nuclear weapons. The neutron generator is a “limited-life” component of a nuclear weapon that uses tritium and must be replaced periodically due to the relatively short half-life of tritium. Neutron generators were produced at the Pinellas Peninsula Plant in Florida starting in the late 1950s. In 1993, as part of the Non-nuclear Reconfiguration Program, Sandia was given the mission assignment for production of various nuclear weapons components, including neutron generators.

SNL/NM also performs weapons research qualification and testing on neutron tube and generator materials, process and lot samples, subcomponents, and post-mortem examinations on final product. The department also performs technical studies that characterize processes and products in collaboration with production and development and design organizations. The site-wide reporting issue for tritium at SNL/NM is about 65,000 curies. The NGPF has a maximum inventory level of 12,000 curies and has the ability to increase to 15,999 curies if required. Presently, the inventory on site at the NGPF is about 3,500 curies.

Figure A.7.1-4—Neutron Generator Production Facility at SNL/NM

A.8 NNSA FLIGHT TEST OPERATIONS

Introduction. NNSA flight test operations is an SNL-managed program to assure compatibility of the hardware necessary to interface between the NNSA weapons and the DoD delivery systems and to assess weapon system functions in realistic delivery conditions. The actual flight tests are conducted with both the B83 and B61 weapons, which are pulled from the stockpile and are converted into JTA units. In addition, development tests of gravity bomb and short-range systems are conducted at Tonopah Test Range (TTR). These flight tests are presently conducted at the TTR, a a 280 square-mile site, located about 140 air-miles northwest of Las Vegas, Nevada. TTR activities include: stockpile reliability testing; structural development R&D; arming, fuzing, and firing testing; testing delivery systems; and environmental restoration. NNSA operates this facility under the terms of a land use agreement with the United States Air Force (USAF) entitled "Department of the Air Force Permit to the NNSA To Use Property Located On The Nevada Test and Training Range, Nevada.". Figure A.8-1 shows the location of TTR and its proximity to NTS.

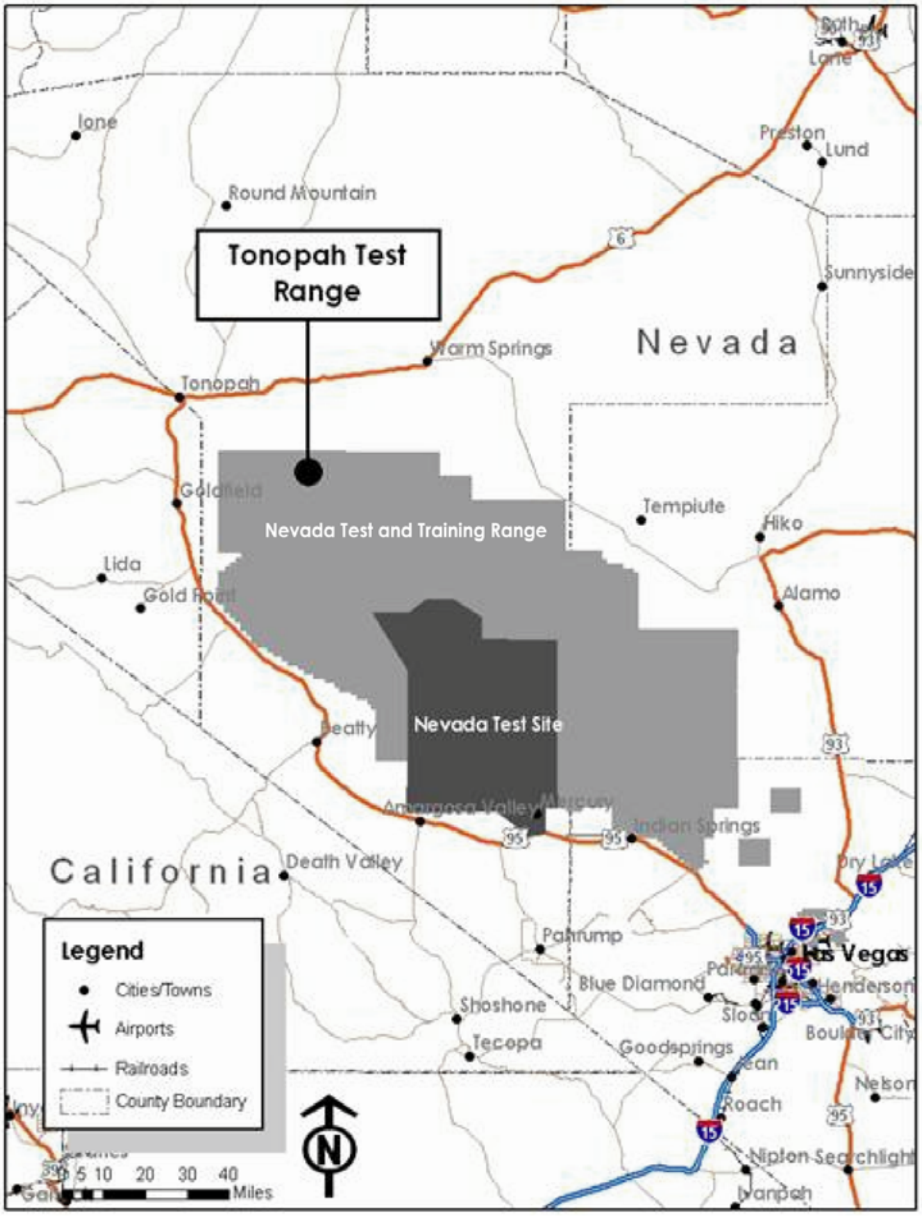


Figure A.8-1—Location of TTR and its proximity to NTS

Conversion of nuclear weapons into JTAs is a multi-step operation. Pantex denuclearizes selected nuclear weapon that become JTAs. These JTAs are not capable of producing nuclear yield. These JTAs may then be further modified at SNL. These JTAs are then dropped from nuclear certified aircraft at various altitudes and velocities. Depleted uranium usually remains in all JTAs but because there is no explosive event, the depleted uranium is contained within the weapon case and fully recovered after each flight test experiment. There is no contamination of the soil as the result of a JTA flight test. In some cases, JTAs are flown at velocities and altitudes of interest and not dropped at TTR. In such cases, the aircraft returns to its base with the JTA onboard. In an average tear, 10 JTAs are tested at TTR. Historically, JTAs included SNM, but NNSA does not plan to use SNM in JTAs after 2008. Therefore, all alternatives assume that SNM would not be present in future JTAs.

In addition to analyzing the impacts associated with the No Action Alternative, four additional alternatives are evaluated in the Complex Transformation SPEIS for conducting NNSA Flight Test Operations. These alternatives are as follows: 1) (1) upgrade the Flight Test Program at TTR; (2) operate the program at TTR in a “campaign” mode; (3) transfer the program to White Sands Missile Range (WSMR) in New Mexico; and (4) transfer the program to NTS. Specific locations within WSMR and NTS are being evaluated to assure that the required geological conditions exist to successfully support all flight testing requirements. Specific locations within WSMR and NTS are being evaluated to assure that the required geological conditions exist to successfully support all flight testing requirements. The locations are also being evaluated for the sufficiency of flight corridors for ingress and egress of test aircraft to the target areas. Infrastructure such as power and roads would also be needed at these new locations or they would have to be constructed to support flight testing activities. NNSA has conducted flight tests at facilities other than TTR, on occasion, when specific test requirements could not be met by TTR assets. Under any of the alternatives considered in this SPEIS, NNSA may continue to conduct one or more flight tests at a different facility, consistent with environmental reviews for that site.

Section A.8.1 describes the No Action Alternative, Section A.8.2 describes the alternative to upgrade TTR, Section A.8.3 describes the alternative to operate TTR in a campaign mode, Section A.8.4 describes the alternative to transfer NNSA’s flight testing mission to WSMR, and Section A.8.5 describes the alternative to transfer the mission to NTS. Analysis of the environmental impacts of the alternatives is contained in Section 5.15. The analysis of alternatives does not affect NNSA’s responsibilities at TTR relating to post-weapons testing by the Atomic Energy Commission, a predecessor agency of DOE (See Section 4.4.6.2.1). Any remediation related to such post-weapons testing is independent of decisions to be made as a result of this SPEIS.

NNSA Flight Test Operations Alternatives

- **No Action.** Continue operations at TTR
- **Upgrade Alternative.** Continue operations at TTR and upgrade equipment with state-of-the-art mobile technology
- **Campaign Mode Operations.** Continue operations at TTR but reduce permanent staff and conduct tests with DOE employees from other sites. Three options are assessed:
    - Option 1—Campaign from NTS: Reduce mission staff and relocate remaining Sandia staff to NTS; O&M and Security taken over by NTS. Additional contract for technical support of equipment is needed for maintenance and upgrade.
    - Option 2—Campaign Under Existing Permit: Reduce mission staff at TTR; campaign additional staff for each test series; SNL to retain O&M responsibilities at TTR; permit would be retained in current form; security responsibilities would be transferred to the Air Force.
    - Option 3—Campaign Under Reduced Footprint Permit: Reduce mission staff at TTR; campaign additional staff for each test series; SNL to retain O&M responsibilities at TTR; permit would be reduced to less that 1 square mile; security, emergency services, power line and road maintenance responsibilities transferred to the Air Force.
- **Transfer to WSMR.** Move NNSA Flight Testing from TTR to WSMR
- **Transfer to NTS.** Move NNSA Flight Testing from TTR to NTS

A.8.1 No Action Alternative

Under the No Action Alternative, NNSA would continue to conduct the flight test mission at TTR. This section describes the NNSA Flight Test Operations Program currently being conducted at the TTR. Figure A.8-1 shows the location of TTR. There would be no construction required at TTR for the No Action Alternative. The current facilities would continue to remain serviceable, assuming adequate funding is provided for the normal maintenance of existing facilities and equipment. Table A.8-1 shows operational requirements for this alternative.

It is noted that the No Action Alternative includes minimal investments to maintain current operations capabilities and to enable a commensurate level of Flight Tests in the future. This investment would maintain the existing TTR capabilities through the year 2030. The TTR can be sustained to meet its present mission requirements only with such minimal reasonable investments in technology and infrastructure. The investment required covers the following areas, the details for each area are described below:

Radar. This includes a transformation of one radar from a maintenance intensive unit to a modern fully functional unit, eliminating the prone to failure systems/parts; a future depot-level maintenance effort for a second radar; and the acquisition of an Identification, Friend or Foe (IFF) system. The acquisition of this IFF system would allow for the elimination of two existing maintenance intensive radar systems.

Optics. The optics group upgrade under this option would consist of three distinct functions: 1) Addition of a Time Space Positioning Information (TSPI) section to collect precise positional data; 2) Addition of an event optics section using telescope tracking mounts to record event data for documentary purposes; and 3) Addition of a photometrics section utilizing both high speed fixed camera arrays to augment the existing still photography capability.

Facilities. TTR will continue to use the existing facilities and maintain them within the normal budget process. A new HVAC system for the control facility and a roof and siding repair on one building would be required under this minimal investment option. Repair to the electrical grid and road surfaces would also be required under this alternative. In addition to these repairs, there are several structures that must undergo D&D in order to continue ongoing operations at TTR.

Table A.8-1—TTR No Action Annual Operational Requirements

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595
Peak electrical demand (MWe)	812
Other process gas (N, Ar, etc.)	480 ft^3
Diesel generators	44 (about 20 per test)
Water (Yearly for entire range including AF)	6 million gallons
Steam (tons)	0
Range area (sq. miles)	280
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 Mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7×10^{-6}
Chemical use	0
Maximum inventory of fissile material/throughput	0
Waste Category	**Volume**
Hazardous	
Liquid (gal.)	150
Solid (yds^3)	3
Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Mixed Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Solid (yds^3)0**Nonhazardous (sanitary)**	
Liquid (gal.)	0
Solid (yds^3)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds^3)	15

Source: NNSA 2007

Past weapons destruction tests, unrelated to the Flight Test Program, have contaminated soil at TTR in three distinct areas. These sites have been characterized, and remediation is ongoing. Additional details on this can be found in Section 4.4.6.2.1 of this document. In addition to these remediation projects, there are several structures which must undergo D&D in order to continue ongoing operations at TTR. It is estimated that the soil and structure remediation activities would entail a two-year project involving 80,000 worker hours, and the requirements listed in Table A.8-2. The soil remediation activities are only the petroleum-contaminated areas under the buildings which are scheduled for demolition. The small quantities of LLW and hazardous wastes generated by this effort would be transported to NTS, or a commercial facility, for treatment and disposal. Nonhazardous waste would be disposed of onsite.

Table A.8-2—D&D Associated with TTR Operations—No Action Alternative

D&D Ongoing at TTR	D&D Amounts
Soil D&D (yd^3)	0
LLW generated (yd^3)	20
Non-Hazardous waste (yd^3)	8000
Hazardous waste (yd^3)	3703
Debris/Earth moving equip.(dozers/trucks)	2/3
D&D Related employment	
Peak	20
Total worker hours	80000

A.8.2 Upgrade of Tonopah Test Range Alternative

This alternative would use High-Tech Mobile (HTM) equipment to reduce the operational costs at TTR through the introduction of newer, more efficient, and more technologically advanced equipment. This alternative would lower manpower test operational needs and keep all test equipment highly reliable and operational between test dates, thereby reducing recalibration and startup requirements and costs. Under this alternative, additional range campaign activities could be considered and conducted with minimal additional costs.

A vision of the HTM at TTR is shown in Figure A.8-2. It includes the acquisition of modern, digital equipment that is compatible with other national test range standards. The emphasis is on highly mobile command, telemetry, communications, and radar units which could be readily moved to the different testing locations at TTR. This would not only eliminate duplicative permanent structures, but would also eliminate costly, startup calibration.

The actions required for the HTM option are as follows:

Documentary/TSPI optics. This action would include an additional five combined mount [TSPI and documentary telescopes] units with a separate optics Control Trailer for remote control operations. Encryption capability would be included.

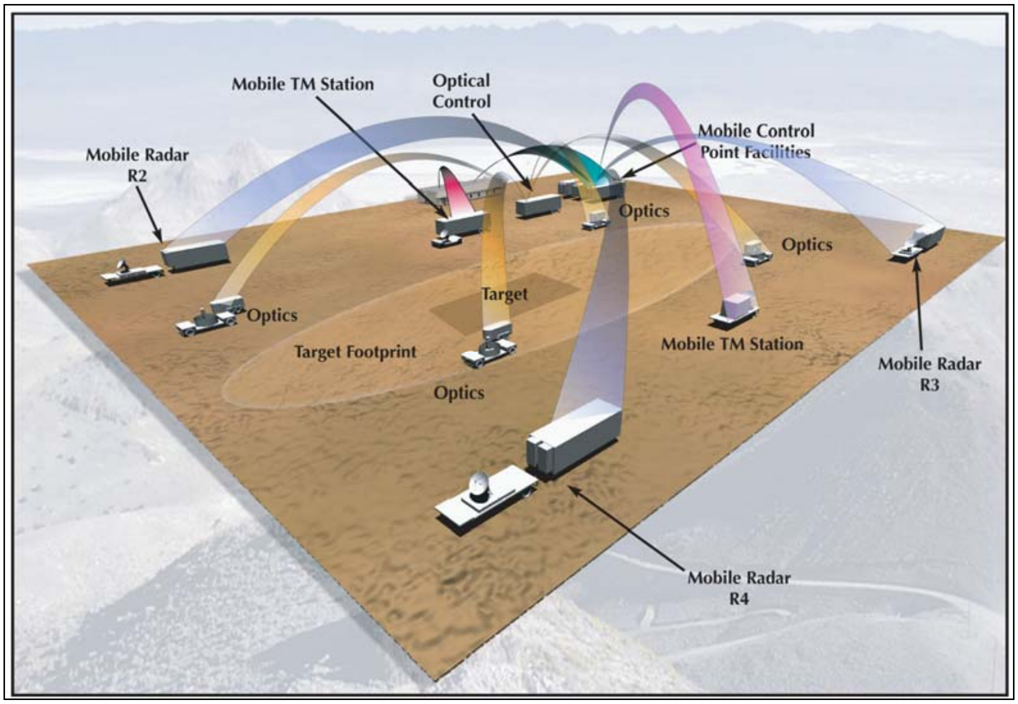


Figure A.8-2—HTM Upgrade Alternative

Radar. The proposal is identical to that proposed above for the minimum investment option.

Telemetry. New telemetry trailers, fully equipped, and antennas would be purchased and all trailers would be DOT-certified. This would allow the telemetry equipment and the antennas to be fully mobile.

Operations control equipment. Two operational control trailers, fully equipped, would be acquired to replace the operations that currently take place in the operational control tower at TTR. Test coordination, communications, and safety would all be housed in these trailers. Operation displays would provide continuous coverage of the test in progress.

Facilities. The proposal is identical to that proposed above for the minimum investment option.

There would be no construction required for the HTM Upgrade Alternative. The HTM Upgrade Alternative would rely on trailer and vehicular modules which would not require any construction. Since this alternative would use existing infrastructure and personnel, without any increases in the number or intensity of tests, the operational resource requirements would be about the same as for the No Action Alternative. TTR would continue to use the existing facilities and maintain them within the normal budget process. A new HVAC system for the control facility and a roof and siding repair on one building would be required under this alternative. Repair to the electrical grid and road surfaces would also be required. In addition to these repairs, there are several structures that must undergo D&D in order to continue ongoing operations at TTR. The requirements for this D&D are listed in Table A.8-2.

A.8.3 Campaign Mode Operation of TTR

An alternative to immediately relocating the entire TTR to another site would be to conduct the JTA tests at TTR on a campaign basis, bringing in employees from other NNSA sites to conduct tests, while doing Work for Others (WFO) as schedule permits. SNL would continue to be the program manager for this operation. Under this alternative, three options are addressed, as described in Table A.8-3.

Table A.8-3—Options for the Campaign Mode Operation of TTR

	Option 1—Campaign from NTS	**Option 2—Campaign under existing permit**	**Option 3—Campaign under reduced footprint permit**
Sandia Staff	Approximately ½ of current TTR staff work from NTS	Approximately ½ of current staff stay at TTR	Approximately ½ of current staff stay at TTR
Campaign Staff	Up to 20 test support personnel campaigned from NTS, Sandia NM & CA	Up to 20 test support personnel campaigned from NTS, Sandia NM & CA	Up to 20 test support personnel campaigned from NTS, Sandia NM & CA
Campaign Period	Each mission would require two week assignment	Each mission would require two week assignment	Each mission would require two week assignment
Campaign Frequency	Up to approximately 12 deployments per year + 1 training period per year	Up to Approximately 12 deployments per year + 1 training period per year	Up to Approximately 12 deployments per year + 1 training period per year
Land Use	180 sq miles	180 sq miles	< 1 sq mile
Technical Contract	New contract required to maintain equipment at TTR during year	None required	None required
O&M Contract	Contractor Managed by NTS	Contractor managed by Sandia	Contractor managed by Sandia
Security	Provided by NTS	Provided by the USAF	Provided by the USAF
Medical and Emergency Servies	Provided by NTS	Downsized -Occupational Medicine and Rescue retained	Downsized -Occupational Medicine and Rescue retained
Infrastructure Maintenance	Provided by NTS	Provided through Sandia contract	Provided by the USAF
Road and Power Line Maintenance	Provided by NTS	Provided through Sandia contract	Provided by the USAF
Deep Recovery of JTAs	Provided by NTS	Provided through Sandia contract	Provided through Sandia contract

Table A.8-3—Options for the Campaign Mode Operation of TTR (continued)

	Option 1—Campaign from NTS	Option 2—Campaign under existing permit	Option 3—Campaign under reduced footprint permit
Equipment investment –	New mobile and transportable equipment	Upgrades to existing equipment	Upgrades to existing equipment

USAF = U.S. Air Force
Source: NNSA 2008a.

<u>Campaign from NTS—additional details:</u>

1. Equipment investment:
   - Radar: Convert one fixed radar to mobile radar and completely refurbish pedestal;
   - Optics: Purchase 3 new documentary telescopes and upgrade 7 cinetheodolites (highly sophisticated optical tracking devices);
   - Telemetry: Replace equipment at risk and refurbish telemetry dish and mounts;
   - Communication Infrastructure: Create Ethernet cell configuration along lake beds and connect Ethernet cells using new fiber optic cable.
2. By the end of 2015, NNSA might decide to:
   - Discontinue NNSA Flight Testing at TTR in approximately 2019 and use the interim period to transition equipment and establish needed infrastructure at NTS or WSMR; or
   - Renew the USAF – DOE permit at TTR (which expires in 2019) and continue work at that site, managed by the Nevada Site Office and SNL.

<u>Campaign Under Existing Permit or Reduced Footprint Permit—additional details:</u>

1. Equipment investment:
   - Radar: Replace electronics in one fixed radar and perform depot level maintenance on pedestal;
   - Optics: Replace all film still and video cameras with modern high frame rate digital units and replace control and pedestal discrete electronics with modern personal computer based commercial-off-the-shelf equipment;
   - Telemetry: Replace equipment at risk and refurbish telemetry dish and mounts;
   - Communication Infrastructure: Use existing radio frequency and fiber backbone and convert custom communications interface to modern commercial-off-the-shelf Ethernet backbone.

This alternative would reduce the number of full-time employees to the level necessary to maintain facilities and equipment; employees from other facilities would complement resident staff in performing the actual tests. The operational requirements for all three options of this alternative are about the same as for the No Action Alternative and are shown in Table A.8-4.

Table A.8-4—TTR Annual Operational Requirements–Campaign Mode

Operation Requirements	Consumption/Use
Annual electrical energy (megawatt-hours [MWh])	595MWh
Peak electrical demand (MWe)	812MWe
Fuel usage (gal or cubic yd)	
Other process gas (N, Ar, etc.)	480 ft^3
Diesel generators	44
Water (Yearly for entire range including AF)	6 million gallons
Steam (tons)	0
Range size (square miles)	280
Employment (workers)	135[1]
Number of radiation workers	25
Average annual dose	<10 mrem
Radionuclide emissions and effluents—nuclides and curies	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7×10^{-6}
Chemical use	0
Waste Category	**Volume**
Hazardous	
Liquid (gal.)	150
Solid (yds^3)	3
Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Mixed Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds^3)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds^3)	15

Source: NNSA 2007.
[1]Total employment – would be split between TTR, AF and SNL employees, as detailed below

For option 1 (Campaign from NTS), this alternative would result in the loss of approximately 92 full-time jobs at TTR through the downsizing of the permanent workforce from 135 to 43. This level of job reductions is different from the two alternatives that terminate all permanent TTR employment through the transfer of flight test operations to another facility. A discussion of the impacts associated with such a reduction in a community where supporting TTR is the primary employer is detailed in the next section. Other impacts, such as fuel, electricity and water usage and waste generation would remain about the same as the no-action alternative, since there would be no change in the number of tests performed. A reduction in employment of this level would have secondary impacts on the service sector and commercial establishments of the area.

For option 2 (campaign under existing permit), this alternative would result in the loss of approximately 57 jobs, but would create approximately 20 jobs for security guards as the AF takes over security responsibilities. The 14 full time Sandia staff is the minimum required to maintain and refurbish equipment to ensure operational readiness.

For option 3 (Campaign under reduced footprint permit), this alternative would result in the loss of approximately 70 jobs, but would create 20 jobs for security guards as the AF takes over security responsibilities. The 14 full time Sandia staff is the minimum required to maintain and refurbish equipment to ensure operational readiness.

Under this alternative, the JTA tests would be conducted on a campaign basis at TTR with support from the NTS, Sandia/NM and Sandia/CA. The remaining staff at TTR would also perform Work for Others (WFO) as time and workload permits. There would be no construction required as the existing facilities at TTR would be used and upgraded to sustain reliable test support.

A.8.4 Transfer to WSMR Alternative

This section describes the alternative for transferring the NNSA Flight Test Operations activities, presently being conducted at the TTR, to the WSMR, near White Sands, New Mexico. Figure A.8-3 shows the location of WSMR. Located in south central New Mexico, WSMR is the largest installation in the DoD. WSMR is a Major Range and Test Facility Base (MRTFB) under the Department of the Army Test and Evaluation Command, Developmental Test Command WSMR possesses extensive capabilities and infrastructure used by the Army, Navy, Air Force, NNSA and other government agencies as well as universities, private industry and foreign militaries. No NNSA activities currently take place on the WSMR. The Range spans 3,420 square miles of land space and 10,026 square miles of contiguous restricted airspace fully managed, scheduled and controlled by the WSMR. Holloman Air Force Base is located within and contiguous to the range east boundary with capabilities for air-craft support and staging.

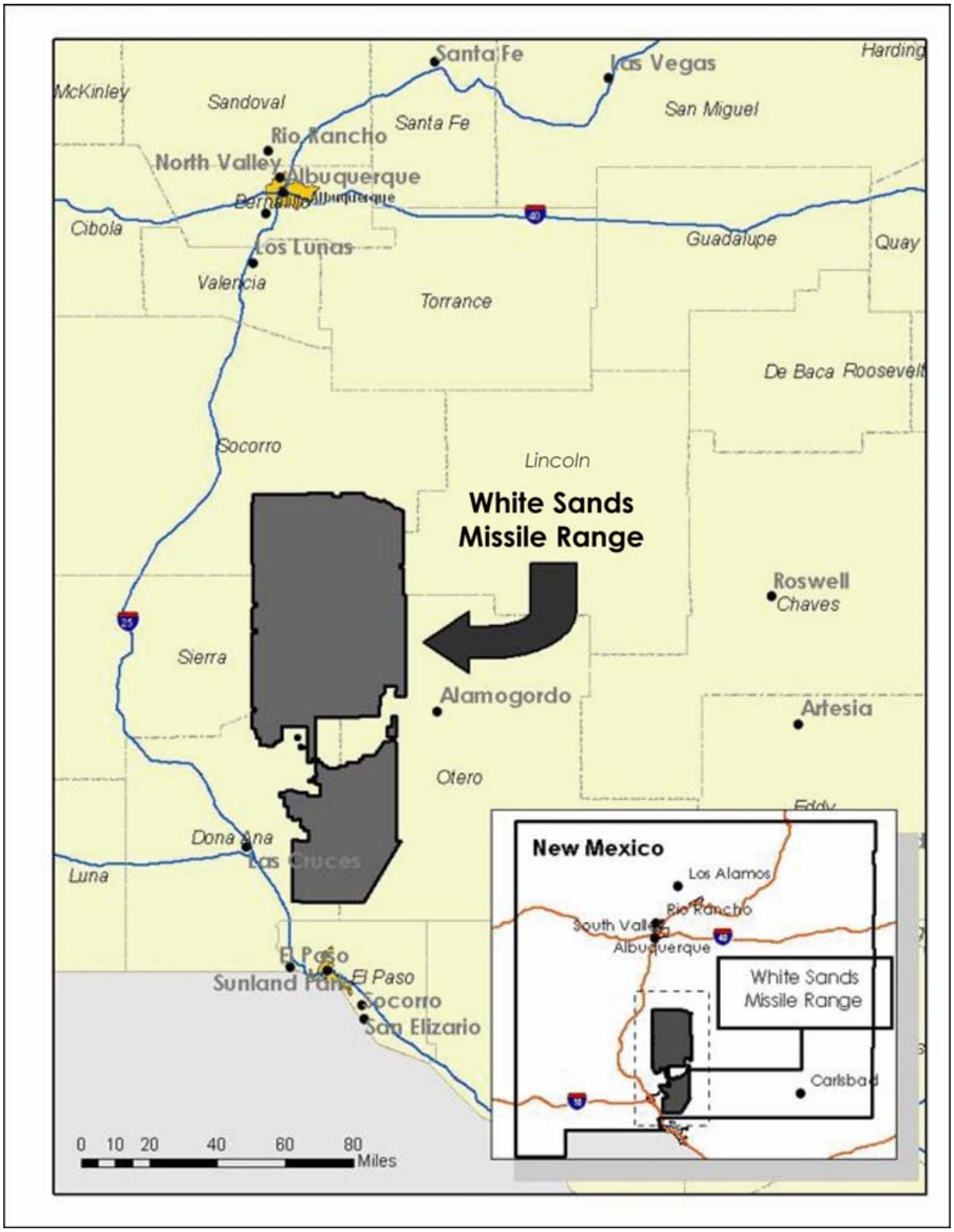


Figure A.8-3—Location of WSMR

WSMR has a full suite of flight test instrumentation including radar, telemetry and optical equipment, which allows complete coverage of NNSA gravity weapons flight testing. As a major range and test facility base, the range infrastructure and instrumentation modernization and maintenance is funded under the DoD Test Resource Management Center and Army Test and Evaluation Command including additional investments made for Air Force, Navy and JTAs. WSMR has extensive experience conducting flight tests with requirements and flight test scenarios similar to the NNSA flight test program to include penetrating weapons, weapons recovery, and handling classified and special materials.

A.8.4.1 *Existing WSMR Capabilities*

Command and Control. The WSMR range control center is a state-of-the-art facility with real-time graphics and telemetry displays, an air traffic control center meteorological data displays, as well as communications centrally connected through the range network infrastructure for data acquisition and distribution across the entire test range.

Optical/video. WSMR has a complete range of optical tracking and video capabilities for event detection, documentation and Time Space and Positioning Information (TSPI) data including position, altitude, aspect angle, and roll rate. WSMR's optical tracking capabilities include mobile and fixed tracking mounts capable of multiple visible, near IR and far IR sensors.

Tracking Radars. The radar suite at WSMR consists mostly of C-band, gated continuous wave (CW), metric radars capable of tracking in skin or beacon mode. There are ten Single Object Tracking radars, of which eight are mobile. In addition, WSMR has two mobile Multiple Object Tracking radars. WSMR also has one mobile Weibel radar Doppler radar.

Telemetry. WSMR has an array of fixed telemetry sites to provide coverage of flight tests across the range and a set of mobile telemetry stations for receiving, recording, and relaying telemetry information at custom locations to meet test requirements. Telemetry data acquisition capabilities include fixed and mobile local and long range secure, multi-stream, and high data rate (excess of 20 megabites per second) telemetry, FM, PCM, PAM, 1553, RS232, 422, IRIG 106, JTIDS/Link 16, and other standard analog and digital data protocols and formats.

Operations Control Center. The Range Control Center (RCC) is a state-of-the-art digital data facility central to test operations, data collection and distribution. The center houses the operations control and data facility, telemetry data center, air traffic control radar facility, network operations center, flight safety engineering, real-time data display and reduction facility, instrumentation controllers, meteorological data center, and test customer and analyst cells.

Photometrics and photography. WSMR has an extensive capability to provide photographic data acquisition, editing, and production for ondemand and planned documentary photo of the test setup and any incidents of interest. Photographic support includes still photography, closed circuit video surveillance, and nontrack optical data video in the visible, image intensification, and IR bands at frame rates up to 2,000 digital and over 20,000 frames per second film.

Communications. WSMR range communications operates the main switch for all telecommunications and network operations including fiber, RF, and hardwire networks. The range utilizes a radio system with repeater systems to provide test conduct and local radio communication service.

Aircraft flight safety. WSMR has a renowned capability and experience in flight safety systems to include modeling and measuring instantaneous impact predictions design, and certification of flight termination systems (FTS), and safe test operations for aircraft and weapons systems. WSMR conducts mission analysis and real-time control and decision making for mission operations including meteorological data considerations, flight profile and instrumentation information for flight safety operations. Aircraft and test operations safety is highly afforded by the control, management and vast restricted air and land space.

Airspace. WSMR controls and manages over 10,000 square miles of restricted airspace with the full authority of the Federal Aviation Administration (FAA). Thus, WSMR is not required to call up or schedule airspace operations or receive FAA approval for operations within the restricted airspace.

Explosive Ordnance Disposal/Recovery. WSMR has trained explosive ordnance disposal and recovery operations personnel for recovery and disposal of explosive ordnance that are utilized either on call or on standby for test operations as required by the test plan and safety operations.

Meteorology. WSMR has a meteorology section that provides a wide range of technical meteorological support including forecasts, warnings, and atmospheric observations and measurements for test data and control.

Trajectory plotting. The graphics facility provides the operational and display environment for the aircraft control operator and the radar director. The displays and the facility are located in the RCC. The trajectory is projected in the RCC operations center for the TD and other test personnel on the same plot as the planned trajectory, allowing the test team to evaluate the aircraft and test unit flight safety.

Security. WSMR has an integral security workforce for operations security, evacuation, and roadblock services across the range. In association with the operation of the nuclear test reactor, WSMR has personnel programs and special security training suitable for NNSA test operation requirements.

Radiological technician. Provided by SNL/NM from Albuquerque. For any tests that require post-test radiography, the equipment and specialists are provided by one of the physics laboratories.

Emergency services. A medical aid station with an ambulance, staffed by highly qualified medical technicians, is located at the Stallion range center within 10 minutes of the planned NNSA test area. Modern full service hospitals are located in the towns of Socorro and Alamogordo, about 20 and 45 miles respectively, from the proposed test location on the range. Additionally, a full-service fire station and Emergency Medical Services (EMS) unit is located at the Stallion range camp.

Shipping and receiving. WSMR performs all requirements to handle, classify, package, and ship hazardous and nonhazardous post-test assets and material off range.

Working space. Workspace for NNSA test operations could be provided by mobile facilities, at the Stallion range camp or at the defense.

Targets. WSMR has a wide variety of targets located throughout the range. Targets similar to those presently used by NNSA at TTR are located in the northern section of WSMR. The final determination of the specific target areas which would be used will be determined by the geological study. Potentially, a concrete target would be constructed in the general area of the penetration target to facilitate all missions in the same location.

Computer facility. The WSMR computer facility is located inside the RCC. This facility provides support to all facets of the test, from safety calculations and basic communications support, to the coordinated real-time radar and video picture so the test team can make instantaneous decisions about range safety and test execution.

A.8.4.2 *Siting Locations*

The northwest area of the WSMR would provide several target area options for flight testing. An Environmental Assessment (EA) is currently being prepared to support core sampling that is Preliminary drilling was conducted at several specific locations within WSMR to determine that the required geological conditions exist to successfully support all flight testing requirements. The locations are being evaluated to assure that the geology would support penetrator testing as well as the sufficient flight corridors for ingress and egress of test aircraft to target areas. Infrastructure such as power and roads would also need to exist or would need to be constructed to support flight testing activities. A review of the preliminary data indicates that this area of the WSMR could accommodate the safety footprints of all current flight test scenarios. Appropriate NEPA analysis would be required, by WSMR, prior to any detailed drilling of any of the candidate sites in order to assess the environmental impacts associated with the required construction of pads and a target and the operations associated with flight testing.

The only construction that would be required to support the JTA flight test operations at the WSMR would be the installation of a circular concrete target. The target aids in recovery of the JTAs used in flight test drops. The concrete target would be constructed of non-reinforced concrete, 500 feet in diameter, with a depth of 12 inches.

Under this alternative, NNSA Flight Testing at TTR would be discontinued. The environmental impacts of discontinuing flight testing at TTR are addressed in Section 5.15.4.2. Table A.8-5 and A.8-4 show the construction and operational requirements for this alternative.

Table A.8-5—WSMR Construction Requirements

Construction Requirements	Consumption/Use
Peak Electrical Energy Use (KW-hr)	40,000
Diesel Generators (Yes or No)	Yes
Concrete (yd3)	800
Steel (t)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Range land required (acres)	3,774
Lay down Area Size	Two 11.5 acre sites
Parking Lots	N/A
Total employment (worker years)	37
Peak employment (workers)	30
Construction period	15 months
Waste Generated	**Volume**
Hazardous	
Liquid (gal)	0
Solid (yds^3)	0
Non-hazardous (Sanitary)	
Liquid (gal)	0
Solid (yds^3)	6,000
Non-hazardous (Other)	
Liquid (gal)	0
Solid (yds^3)	45

Table A.8-5—WSMR Operational Requirements (continued)

Operation Requirements	Consumption/Use
Annual electrical energy (MWh)	595
Peak electrical demand (MWe)	812
Fuel usage (gal)	32,150
Other process gas (N, Ar, etc.)	480cu.ft.
Diesel generators	44 (about 20 per test)
Water (Yearly in gallons)	6 million gallons
Steam (tons)	0
Plant footprint (acres)	
Employment (workers)	135
Number of radiation workers	25
Average annual dose	<10 Mrem
Radionuclide emissions and effluents—	0
NAAQS emissions (tons/yr)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	3.7×10^{-6}
Chemical use	0
Maximum inventory of fissile material/throughput	0
Waste Category	**Volume**
Hazardous	
Liquid (gal.)	150
Solid (yds^3)	3
Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Mixed Low-Level	
Liquid (gal.)	0
Solid (yds^3)	0
Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds^3)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds^3)	15

Source: NNSA 2007

The only construction that would be required to support the JTA flight test operations at the WSMR would be the installation of a circular concrete target and associated pads. The target would be used to aid in recovery efforts. It would also be used for free-fall test units. The concrete target would be constructed of 4000 psi non-reinforced concrete, 500 feet in diameter with a depth of 12 inches. Tables A.8-1 and A.8-2 provide the construction and operational requirements associated with relocating NNSA flight test operations to the WSMR.

The required construction is a small project and it is not anticipated that the employment of 30 construction personnel over a 15-month period would have a significant impact on the existing labor pool of the area.

During flight test operations, the primary noise would be generated by aircraft flying over the WSMR drop areas. The noise would be sporadic and would be mitigated by the distance of the tests to the nearest public receptors. The effects of these operational activities would be primarily limited to those employed by WSMR. They would not likely result in any adverse effect on sensitive wildlife species or their habitats, and would be similar to the effects discussed under the No Action Alternative.

Similarly, workers, the public, and sensitive wildlife receptors are unlikely to be adversely impacted by increased flights at WSMR as a result of NNSA conducting flight test operations. Workers are allowed to experience impulsive/impact noise events up to a maximum of 140 dBC and are remotely located from the flight-path of the aircraft. The public is not allowed on WSMR and noise levels produced by the aircraft are sufficiently reduced at locations where the public would be present to preclude hearing damage.

Sensitive wildlife species are unlikely to be adversely affected by the aircraft noise. WSMR has conducted such tests on a weekly basis over a number of years with no apparent adverse impacts to any species.

In is assumed that operational impacts, as shown in Table A.8-8 would be the same as the operational requirements for the No Action Alternative operation at TTR. Although they will certainly be different, current operational requirements are the best estimate, as there is no reason to believe the actual operation of JTA tests would be sufficiently different from the existing operation.

A.8.5 Transfer to NTS Alternative

This section describes the alternative for transferring the NNSA flight test operations activities, presently being conducted at the TTR, to the NTS. Figure A.8-1 shows the location of TTR and its proximity to NTS. This alternative involves transferring NNSA Flight Test Operations to NTS (Figure 3.10-4). It is estimated that a site of about two acres would be required. A review of three possible Areas at NTS (five separate sites) was conducted (see Figure 3.10-4). NNSA evaluated these locations at NTS to determine if flight testing could be conducted safely with the appropriate ingress and egress corridors for flight test aircraft and if the soil geology was suitable for testing requirements. Preliminary drilling was conducted to assure that the location would have the required soil geology. Appropriate NEPA analysis would be required prior to any detailed drilling of any of the candidate sites in order to assess the environmental impacts associated with the required construction of pads and a target and the operations associated with flight testing. Although the isolation of the NTS is a benefit for security and flight path purposes, the remoteness of these site locations could require an investment in road and utility infrastructure. A preliminary assessment indicates that these sites meet the necessary safety criteria for flight paths and target location to permit the program to use these areas of NTS. Other sites may be available at NTS, but these three sites meet the mission needs and provide a reasonable number of site alternatives for consideration.

If this alternative were to be selected, transition from TTR to NTS could occur as early as the latter part of 2009 and the beginning of 2010. Upgrades would only begin after the construction of the needed facilities was completed and transition of personnel and equipment completed. NNSA would need to construct pads and a target and possibly some road and utility infrastructure. [a1]Flight Test Program system upgrades would only begin after completion of the required NEPA analysis, construction of required infrastructure and facilities, and the completion of transition. The JTA Flight Test Program staff would be housed in CP-40, an existing NTS facility that includes office space and an available high-bay area, which could accommodate high-tech mobile equipment. Minor building preparation could be required. The concrete target would be constructed of non-reinforced concrete, 500 feet in diameter with a depth of 12 inches.

Under this alternative, NNSA flight testing would be discontinued at TTR. The environmental impacts of discontinuing NNSA flight testing at TTR are addressed in Section 5.15.4.2.

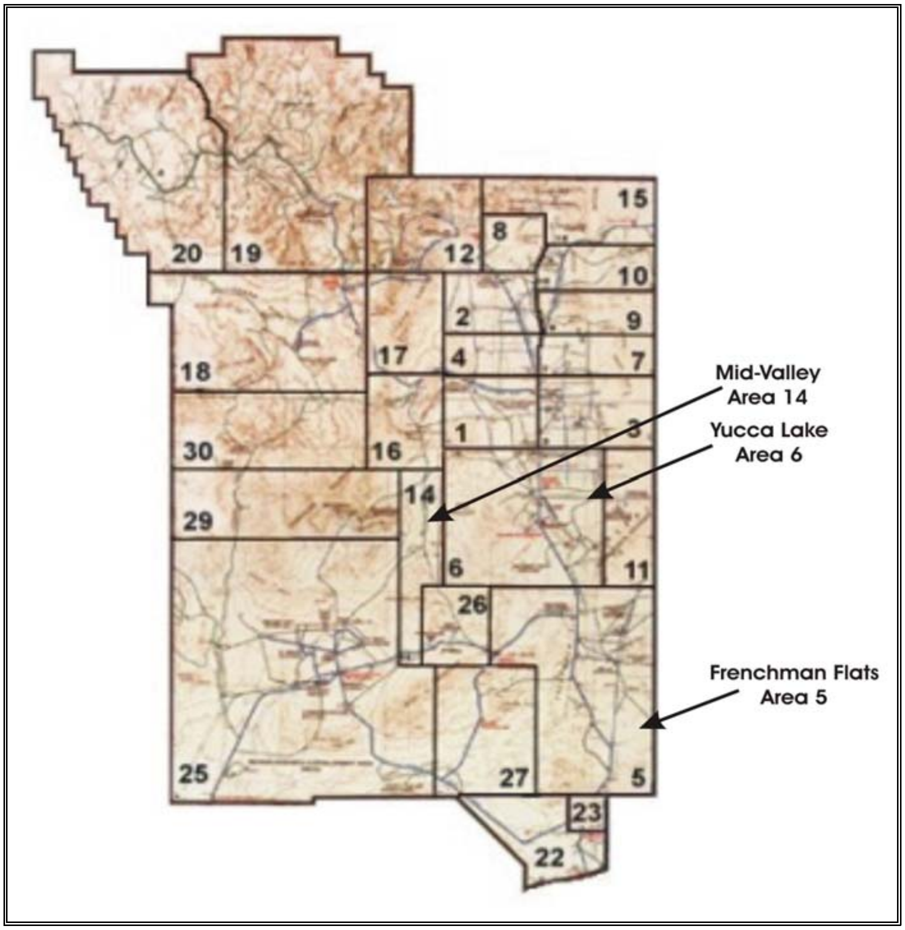


Figure A.8-4—Potential Flight Test Sites at NTS

Figure A.8-5—CP-40 includes administrative areas and a high bay that would be useful for personnel and assembling test hardware

Figure A.8-6—CP-20 is an ideal facility for housing the electronics for the Flight Test Program

Existing communications capabilities between the CP facilities located in the southeast portion of Area 6, include a fiber optic link between the CP microwave towers and CP-1, 20, and 40. Microwave data communications are available for connecting data and video requirements from the target area to the CP complex. Setup of the microwave data/video links is a routine test requirement on the NTS. These same communications infrastructure elements can readily be applied to other locations on the site should the JTA Flight Test Program desire to test in different geological regimes.

A.8.5.1 *Construction Requirements*

As mentioned in the sections above, a target area would have to be constructed and a few enhancements to Building CP-40 would have to be made. The following tables give the impacts associated with the required construction and for the operation of the Flight Test Operations Program at NTS. Table A.8-6 and A.8-7 show the construction and operational requirements for the Relocation of Flight Test Operations to NTS Alternative.

Table A.8-6—Construction Requirements for NTS Alternative

Construction Requirements	Consumption/Use
Peak Electrical Energy (MWh)	40,000
Diesel Generators (Yes or No)	Yes
Concrete (yd^3)	800
Steel (t)	1
Liquid fuel and lube oil (gal)	32,000
Water (gal)	2,880,000
Range land required (acres)	3,774
Laydown Area Size	Two 11.5 acre sites
Parking Lots	N/A
Construction Employment	0
Total employment (worker/yr)	37
Peak employment (workers)	30
Construction period (months)	15
Waste Generated	**Volume**
Low level	
Liquid (gal)	0
Solid (yd3)	0
Mixed Low-level	
Liquid (gal)	0
Solid (yd3)	0
Hazardous	
Liquid (gal)	0
Solid (yd3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	6,000

Table A.8-6—Construction Requirements for NTS Alternative (continued)

Waste Generated	Volume
Solid (yd3)	
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd3)	45

Source: NNSA 2007.

Table A.8-7—Operation Requirements for NTS Alternative

Operational Requirements	Consumption/Use
Annual Electrical energy (MWh)	595
Peak electrical demand (Mwe)	812
Fuel usage (gal)	32,150
Other Process Gas (N, Ar, etc)	480 cubic feet
Water (gal)	6,000,000
Steam (tons)	0
Range land required (acres)	3,047
Employment (workers)	129
Number of Radiation Workers	1
Average annual dose (per Sandia)	<10 mrem
Radionuclide emissions and effluents	0
NAAQS emissions (tons/yr) (per Sandia)	13.32
Hazardous Air Pollutants and Effluents (tons/yr)	HCL - 3.7E-06
Chemical Use (per Sandia)	0
Maximum inventory of fissile material/throughout	0
Waste Category	**Volume**
Hazardous	
Liquid (gal.)	150
Solid (yds3)	3
Low-Level	
Liquid (gal.)	0
Solid (yds3)	0
Mixed Low-Level	
Liquid (gal.)	0
Solid (yds3)	0
Solid (yds3)0Nonhazardous (sanitary)	
Liquid (gal.)	0
Solid (yds3)	63
Nonhazardous (Other)	
Liquid (gal.)	700
Solid (yds3)	15

Source: NNSA 2007.

A.8.6 Transportation

All post-test transportation from the NTS to Pantex would be identical to the transportation requirements of the current TTR process. New agreements replacing NTS as the originating site would replace the TTR agreements. NTS has a long history including formal agreements with Albuquerque for the shipment of SNM and classified components to and from major DOE/NNSA sites and is therefore thoroughly familiar with the processes and procedures for these shipments.
Due to the proximity of all alternative sites, the transportation requirements are similar for all three alternatives. All transportation of nuclear weapons, as well as JTAs, is conducted in DOE safe secure trailers by the DOE Office of Secure Transport, based in Albuquerque, New Mexico. Vehicles are state of the art, and all personnel associated with such shipments are highly trained both initially and on an ongoing basis. Although routes have been determined and environmental impacts evaluated for such transport, specifics of this information are not available to the public.

A.8.6.1 *Removal of Weapons From the Stockpile*

Under the existing operation at TTR, weapons are removed from the stockpile at various locations across the U.S. and abroad and are transported to Pantex. The specific locations are not for public release. Once the weapon has been inspected, the SNM removed from the weapon, and instrumentation added to the weapon, the weapon is considered a JTA. Transportation required to support this activity would be the same as for existing operations and would be the same for all alternatives.

A.8.6.2 *Transport of JTAs to Air Force Installations To Be Loaded Onto Test Aircraft*

Once the JTAs have been inspected and certified at Pantex, they are transported to USAF installations on DOE's fleet of SST vehicles to be loaded onto test aircraft. Transportation required to support this activity would be the same as for existing operations and would be about the same for all alternatives.

A.8.6.3 *Transport of JTAs From Test Site to Pantex*

Once the JTA test has been completed, the JTA is returned to Pantex for post testing analysis and disposition. For flyover tests, this transportation route would be from the Air Force installation from which the aircraft originated to Pantex. Transportation required to support this activity would be the same for existing operations as it would be for all alternatives. Dropped JTAs would be transported from the test facility to Pantex. Transportation required to support this activity would be site specific and vary for each alternative site. The No Action Alternative, the two TTR Upgrade Alternative, and the relocation to NTS would all be similar, since the distances and routes to Pantex are about the same for TTR and NTS. The transportation route from the relocation to the WSMR Alternative is less than half of the other two alternatives.

A.9 HYDRODYNAMIC TESTING

Hydrodynamic testing (hydrotesting) is the execution of high explosive (HE)-driven experiments to assess the performance and safety of nuclear weapons. Data from experiments including hydrotesting, coupled with modeling and simulation using high performance computers, is used to certify the safety, reliability, and performance of the nuclear physics package of nuclear weapons without underground nuclear testing.

The alternatives for meeting the goal of the National Hydrotest Plan (NHP) are explained in the sections that follow. Section A.9.1 discusses the No Action Alternative, which would continue operations at the existing facilities of LANL, LLNL, NTS, SNL, and Pantex. Section A.9.2.1 discusses an alternative which would downsize the number of hydrotesting facilities at LANL, LLNL, NTS, SNL, and Pantex. Section A.9.2.2 discusses an alternative that would consolidate nonfissile hydrotesting activities at LANL. Section A.9.2.3 discusses a next generation alternative which would consolidate all hydrotesting activities at the NTS.

Hydrodynamic Testing Alternatives

- **No Action. C**ontinue hydrotesting at LLNL, LANL, NTS, Pantex, and SNL/NM
- **Downsize in Place**
  - Consolidate LLNL hydrotesting at Contained Firing Facility (CFF)
  - Consolidate LANL hydrotesting at Dual Axis Radiographic Hydrodynamic Test (DARHT) facility
  - Consolidate NTS hydrotesting to single confined and single open-air sites
  - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidation at LANL**
  - Integrate hydrotesting program at LANL
  - Construct new CFF-like facility at LANL
  - Discontinue hydrotesting at LLNL once CFF-like facility is operational
  - Maintain BEEF at NTS
  - Discontinue hydrotesting at Pantex and SNL/NM
- **Consolidation at NTS**[1]
  - Integrate hydrotesting program at NTS
  - Construct new DARHT-like facility at NTS
  - Construct new CFF-like facility at NTS
  - Discontinue hydrotesting at LLNL, LANL, Pantex, and SNL/NM

[1]The NTS Alternative is considered a "next generation" alternative because NNSA is not proposing these changes at this time.

Hydrotesting coupled with high performance computer modeling and simulation and data from data processing equipment (DPE), is used to certify the safety, reliability, and performance of the nuclear physics package of nuclear weapons without underground nuclear testing. Radiographic images and other data from hydrotesting help to ensure continued confidence in NNSA's assessments of nuclear weapons by providing critical experimental data for representative nuclear weapons geometries, fine tuning computer modeling of nuclear weapons performance and behavior, evaluating effects of aging on materials, and evaluating performance of remanufactured or new materials and components.

As described in Section A.9.1, the majority of stockpile stewardship hydrotesting is conducted at LLNL in the Contained Firing Facility (CFF) at Site 300 and at LANL at the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT). The diagnostic capabilities have been developed at these two facilities to meet specific nuclear weapons design and agency needs. Hydrotesting is also conducted at Pantex, SNL/NM, and NTS to support surveillance, production and fundamental equation of state (EOS) research on shock-driven plutonium. No single existing NNSA hydrotest facility offers all of the diagnostic capabilities or capacity necessary to meet the entire hydrotesting requirements for certifying the safety and reliability of the nuclear weapons stockpile.

The goal of NNSA's NHP is to meet the hydrotest requirements for certifying the safety and reliability of the nuclear weapons stockpile. This will require a wide range of facility capabilities to enable scientists from around the Complex to deal with differing issues. In addition, since the large hydrotesting experiments involve the development and detonation of state-of-the-art HE, many of the hydrotesting facilities are well suited for other uses and are therefore used for experiments which fall outside the scope of large-scale hydrotesting. Conversely, many of the HE R&D facilities are able to support hydrotesting experiments.

A.9.1 No Action Alternative

This section describes the hydrotesting facilities and missions currently being conducted at weapons complex sites. A summary of this information may be found in Section 3.11.

A.9.1.1 *Hydrotesting Facilities at LLNL*

LLNL's Site 300 has been used since 1955 to perform experiments that measure variables important to nuclear weapon safety, conventional ordnance designs, and possible accidents (such as fires) involving explosives. The facilities used for Site 300 firing activities consist of four firing point complexes and associated support facilities. The locations of the four firing complexes are indicated in Figure A.9-1.

The Building 801 Complex comprises Buildings 801A, 801B, and 801D, and encompasses approximately 51,000 square feet. The Building 801 Complex is in the northeast quadrant of the site, called the east firing area.

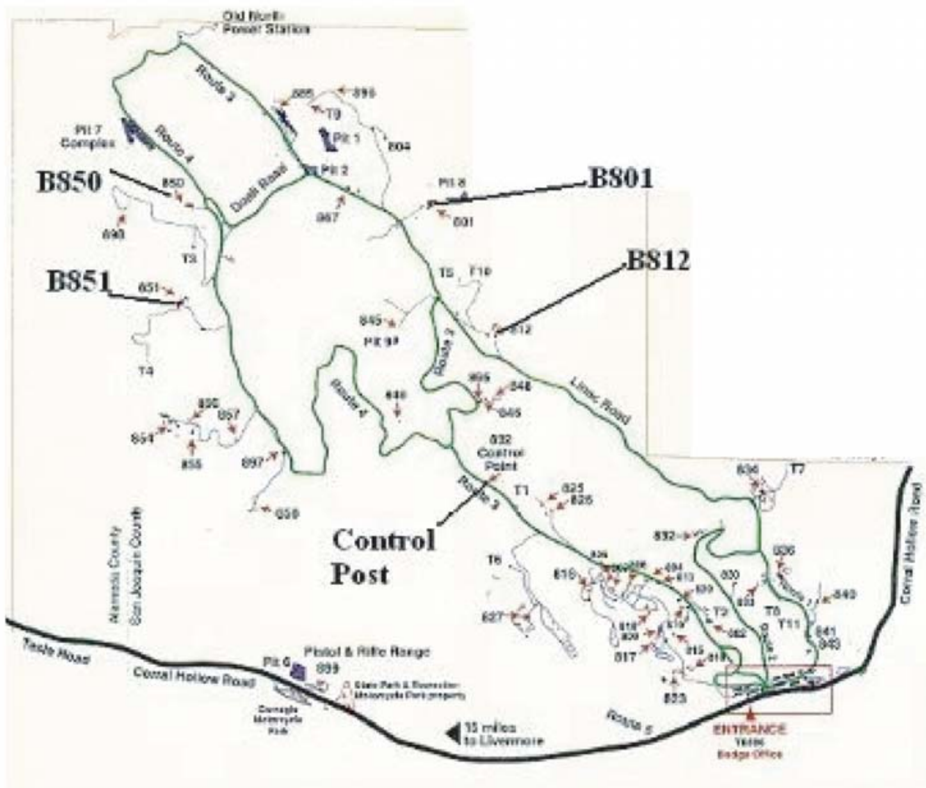


Figure A.9-1—Locations of B801, B812, B850, and B851 at Site 300

Building 801 Complex

The CFF is located at the Building 801 Complex and is capable of full-scale dynamic weapons radiography (Figure A.9-2). Without the validation provided by underground nuclear tests, LLNL and LANL scientists must utilize the results of experiments conducted here to assure the safety and reliability of our Nation's nuclear stockpile as weapons age beyond their originally planned life. The data gathered at the CFF, in conjunction with computer modeling supplies a wealth of information about how the explosives and assemblies in nuclear weapons will behave. The CFF drastically reduces emissions to the environment and minimize the generation of hazardous waste, noise, and blast pressures.

Figure A.9-2—The Contained Firing Facility at the Building 801 Complex

CFF is a permanent, state-of-the-art firing chamber constructed on the site of Building 801's previous open-air firing table. The CFF additions consisted of four components: a firing chamber, a support area, a diagnostic equipment area, and an office/conference module. The heart of the CFF is the firing chamber. Slightly larger than half a small gymnasium (52 by 60 feet and 32 feet high), the firing chamber contains the blast overpressure and debris from detonations of up to 60 kilograms of cased explosive charges. The inside surfaces of the chamber are protected from shrapnel traveling as fast as 1.5 kilometers per second with 38-millimeter-thick mild steel plates. To permit repetitive firings, all main structural elements of the firing chamber are required to remain elastic when subjected to blast. Detonations will be conducted above a 150-millimeter-thick steel firing surface (the shot anvil) embedded in the floor.

All main structural elements of the firing chamber must be able to withstand repetitive firing as well as meet design safety standards. These criteria require the structure to withstand a 94-kilograms TNT blast, which is the equivalent to 60 kilograms of HE. During the testing phase of the project, "overtests" were run using 75 kilograms of HE to assure that the building can withstand planned 60- kilograms detonations.

A key aspect of the new facility is that the rectangular concrete firing chamber was made with low-cost, conventional reinforcement, as opposed to the labor-intensive, laced reinforcement commonly found in many blast-resistant structures. From a materials standpoint, a spherical chamber shape would have been more blast efficient, but a slightly heavier, rectangular shape was cheaper to construct, provides easier and more desirable setup and working surfaces, and encompasses existing diagnostic systems. The thickness of the reinforced concrete walls, ceiling, and floor of the chamber are 3.9, 4.6, and 5.9 feet, respectively. The support area, which measures about 16,000 square feet, is for preparing the nonexplosive components of an experiment and also for equipment and materials storage, personnel locker rooms, rest rooms, and decontamination showers. It also houses filters, scrubbers, and a temporary waste-accumulation area for the waste products from testing.

In addition to the CFF, Building 801 Complex is designed to obtain explosives test data through the use of the flash x-ray accelerator, designed to accelerate charged particles and generate x-rays; a high-speed camera; and a laser-doppler interferometry operation. About 26,000 additional square feet were recently added to Building 801, also the site of LLNL's recently upgraded 18-megaelectron-volt flash x-ray (FXR) machine. Building 801 contains a variety of other advanced, high-speed optical and electronic diagnostic equipment that together constitute a unique capability to diagnose the behavior of HE-driven assemblies. This equipment measures the velocity of explosively driven surfaces. Other electronic and mechanical systems capable of diagnosing various aspects of the high explosives tests are housed in Building 801 Complex facilities.

A.9.1.1.1 Building 812 Complex

The Building 812 Complex is an active open-air explosives firing facility. The complex includes five buildings (Buildings 812A, 812B, and 812C, 812D [currently inactive], and 812E), two magazines, and an open-air firing table. Building 812E is currently used to repair and test portable x-ray equipment. The current total operational building area is 5,532 square feet.

A.9.1.1.2 Building 850 Complex

The Building 850 Complex is an explosives testing facility. This 5,840 square-foot complex consists of Bunker 850 and a magazette in the northwest quadrant of the site (called the west firing area) and comprises an active firing, explosives test, and high-speed camera repair and test facility. The multidiagnostic facility includes a permanently mounted, smooth-bore, 155-millimeter gun for conducting impact experiments, high-speed rotating-mirror cameras, specialized light sources, portable flash x-ray sources, and various other diagnostic equipment.

This facility has an outdoor detonation firing table with gravel-covered pads for stands of concrete, wood, or steel. During an experiment, the explosive is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. This debris is potentially contaminated with high explosives, beryllium, and depleted uranium.

A.9.1.1.3 Building 851 Complex

The Building 851 Complex is part of the explosive test facility operations. This 13,681 square-foot complex is in the northwest quadrant of the site and houses specialized laser equipment in a laser room, several laboratories, a portable x-ray room, several shop areas, and offices.

Building 851 Complex includes an open-air firing table of gravel-covered pads with stands of concrete, wood, or steel. During an experiment, an explosive device is placed on the test stand and fired. The firing debris may consist of wood, plastic, wiring, and gravel. The debris is potentially contaminated with unexpended explosives, beryllium, and depleted uranium.

Building 851 Complex is equipped for the radiography of explosives devices during detonation testing, including high-speed rotating-mirror cameras; optical interferometry for precise, free-surface velocity measurements; electronic pin timing diagnostics; and various other photo processing operations that involve both manual and automatic film and paper developing.

A.9.1.2 *Associated Support Facilities*

The following list includes facilities that are necessary support facilities for hydrotesting or facilities that are necessary to the operation of Site 300 as a hydrotesting facility:

- Site 300 HE casting and machining facilities (covered under HE R&D);
- Site 300 Shaker and Environmental test facilities (covered under Environmental Testing); and
- Site 300 supporting magazines, shops, offices, observation posts, guard stations, and materials management

Four other facilities which do not conduct hydrotesting experiments, but are necessary for supporting the hydrotest facilities are not addressed here, since they are addressed in the HE R&D or Environmental Testing Sections. These four facilities are as follows:

A.9.1.2.1 Building 806 Complex

The Building 806 Complex is located in the process area in the southeast quadrant of Site 300 and consists of Buildings 806A and 806B. This 8,314 square foot complex is used for machining and inspecting explosive parts. Explosives are also temporarily stored at the complex.

A.9.1.2.2 Building 810 Complex

The 5,079 square-foot Building 810 Complex is located in the process area, in the southeast quadrant of Site 300, and consists of Buildings 810A, 810B, and 810C. Building 810A and 810B are used to assemble explosives parts into test components. Building 810A is also used for the temporary storage of explosives components. Building 810C is used for storing nonexplosive parts for test components. The test components may also include beryllium, lithium, tritium, thorium, or depleted uranium.

A.9.1.2.3 Building 823 Complex

The 2,748 square-foot Building 823 is in the southeast quadrant of Site 300 and consists of two buildings. Building 823A contains office space, a darkroom with a radiographic film processor, and control panels for three real-time imaging systems housed in Building 823B. These units include a transportable 9-million-electron-volt (MeV), a 2-MeV, and 120-thousand-electron-volt (KeV) x-ray machines. Building 823B contains staging and real- time imaging systems, and a doubly encapsulated cobalt-60 isotope source in a lead-shielded radiographic projector. The isotope source is no longer operational and is being stored in Building 823 until it is sent back to the manufacturer for disposal. This complex provides the means for radiographic inspection of pressed explosives parts and weapon test components. After x-ray film has been exposed in

Building 823B, it is processed through the automatic film processor in Building 823A.

Building 823B has an earthen berm on two sides that provides radiation shielding for the office/control building located east of the berm. The Varian 9-million-electron-volt LINAC is used in Building 823B to beam into the open space directly to the west.

A.9.1.2.4 Building 845, Explosive Waste Treatment Facility (EWTF)

The EWTF is a 666 square-foot facility located in the north-central section of Site 300. The EWTF replaced Building 829, which had been closed. The EWTF consists of an earth-covered control room, Building 845A; an inert storage area, Building 845B; a thermal treatment unit (burn cage), an open burn unit (burn pad), and an open detonation unit (detonation pad). The EWTF is permitted under a hazardous waste permit issued by the California Department of Toxic Substance Control for the treatment of explosives waste. Treatment of other hazardous, radioactive, or mixed waste materials is prohibited.

A.9.1.3 *Hydrotesting Facilities at LANL*

The Hydrotesting Facilities at LANL are located within one of the five TAs that contain HE R&D facilities. TA-15, located approximately 2.6 miles from the main administrative area,in the central portion of LANL, is the location of two firing sites: the DARHT, which has an intense high-resolution, dual-machine radiographic capability, and Building 306 (R306), a multipurpose facility where primary diagnostics are performed (see Figure A.9-3). Currently, there exists no permanent radiographic capability at R306. Figure A.5.1-4 shows the location of TA-15 at LANL. The Pulsed High Energy Radiation Machine Emitting X-Rays (PHERMEX) Facility, a multiple-cavity electron accelerator capable of producing a very large flux of x-rays, was disabled in 2004. D&D of this facility has not yet been completed. LANL conducts about 100 hydrotest experiments a year.

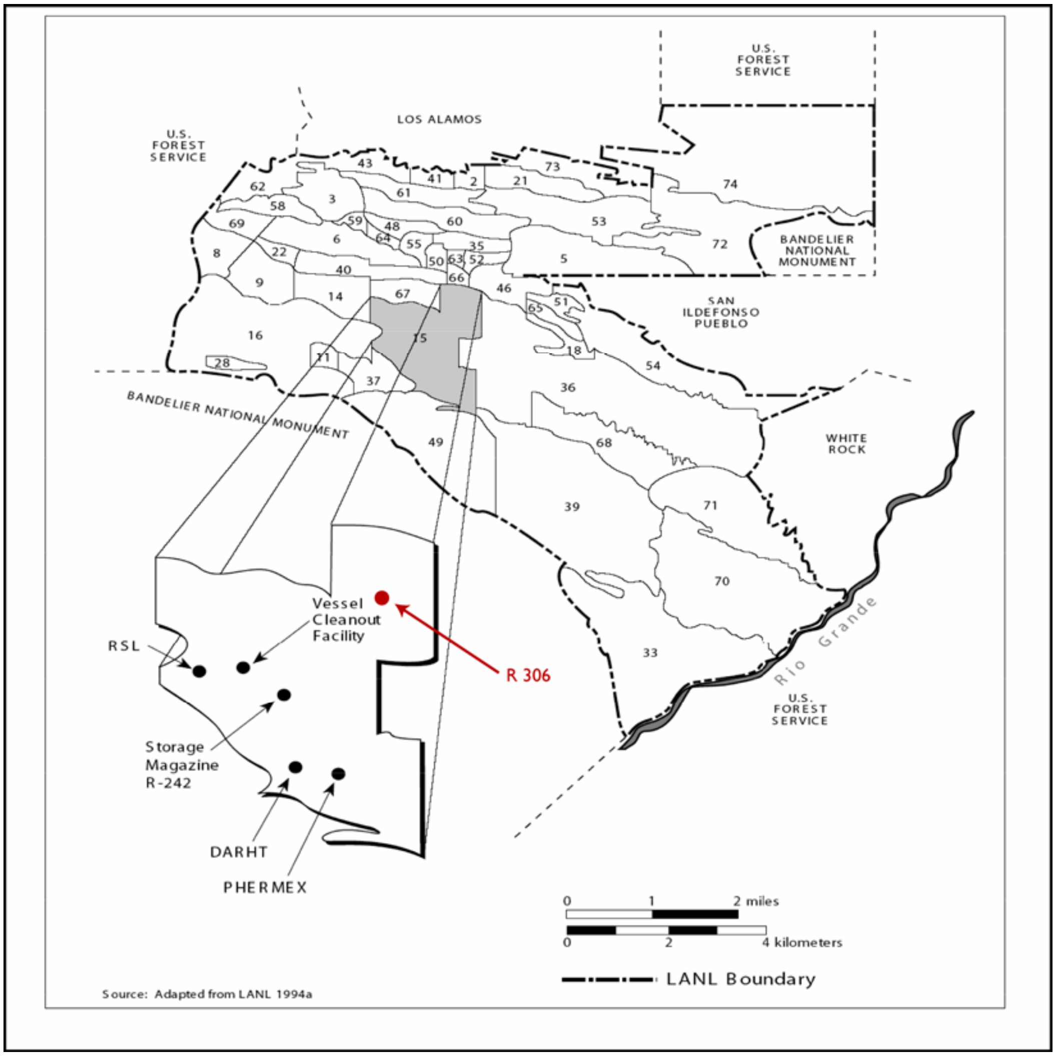


Figure A.9-3—TA-15 at LANL

DARHT is a state-of the-art, full scale radiography facility and is used to investigate weapons functioning and systems behavior in nonnuclear testing. DARHT is designed to include two high intensity x-ray machines whose beams cross at right angles. Each machine has been designed to generate radiographs of far higher resolution than anything previously obtainable—the resolution required for stockpile stewardship without underground nuclear testing. The first axis became operational in 1999, and the second axis was tested in late 2002. In 2003, LANL began refurbishing failing accelerator cells Facility Axis II in order to bring them up to design specifications. The injector for the second axis of DARHT is now being “tuned” in preparation for undergoing commissioning tests. When DARHT becomes fully operational, its multi-axis large scale hydrodynamic tests will allow researchers to obtain three-dimensional as well as time-resolved radiographic information. Figure A.9-4 shows the DARHT facility.

The DARHT x-ray machines are based on linear induction accelerators, a technology derived from that of the Fusion Energy Research Program at Lawrence Berkeley Laboratory. An intense pulsed electron beam strikes an x-ray target, creating x-rays. The first machine provides a pulse 60 nanoseconds long. In the second machine, a "macropulse" 1.6 microseconds long will be chopped into four shorter pulses, providing four snapshots in quick succession. One of the pulses from the second axis will be able to be synchronized with that of the first axis so that three-dimensional information can be reconstructed..

Figure A.9-4—The DARHT at LANL

TA-15 also includes office space for approximately 100 staff in buildings 494, 484, and 183. The DARHT uses office space at Building R306. Also in TA-15, is the Vessel Preparation Building that serves as a facility to clean out the steel vessels used in hydrodynamic testing. The Vessel Preparation Area also includes a low-energy x-ray calibration facility, a carpenter shop, and a warehouse.

Additional facilities required to support hydrotesting are located in six other TAs, at LANL. The Test Device Assembly Building is one such facility. The Test Device Assembly Building provides the capacity to assemble test devices ranging from full-scale nuclear-explosive-like assemblies (where fissile material has been replaced by inert material) to materials characterization tests. In addition to assembly operations, other facilities conduct explosives testing support and radiography examinations of the final assemblies. Other activities conducted at these support facilities support HE R&D. LANL also performs R&D and fabrication of high-power detonators at these facilities.

A.9.1.4 *Hydrotesting Facilities at Pantex, SNL/NM, and NTS*

Smaller hydrotest facilities, which are not capable of dynamic weapons radiography, are also located at Pantex, SNL/NM, and NTS. Both Pantex and SNL/NM have several outside blasting table facilities which are primarily used for HE R&D activities and can only handle small hydrotesting experiments. NTS has several facilities which are utilized for very large explosion-type experiments. The BEEF is one such facility at NTS, which is the only NNSA facility where some experiments, due to the amount of HE utilized, can be conducted. Three additional and similar facilities at Pantex conduct both HE R&D and hydrotesting experiments. All three will require upgrades within the next several years. The upgrades will include two open-air firing sites with bunkers and one facility containing indoor firing chambers. SNL/NM has several small HE R&D firing sites and the Explosives Component Facility and ancillary facilities, which have been used for hydrodynamic tests. Because none of SNL/NM's facilities are used primarily for hydrotesting, they are described more completely in the No Action Option for HE R&D in Section 3.7.2.1. The Explosives Component Facility and its ancillary locations support the design, development, and life cycle management of all explosive components outside the nuclear package.

A.9.2 Action Alternatives

A.9.2.1 *Downsize in Place Alternative*

This option would continue hydrotesting activities by consolidating LANL activities at the DARHT, consolidating LLNL activities at Building Complex 801 and the CFF, closing some of the smaller facilities at both of these sites, and moving tests requiring larger amounts of HE to the BEEF at NTS and LANL. Although outside the scope of large-scale hydrotesting, six firing sites at Pantex, used for HE production, development, and surveillance, and also previously used on an intermittent basis for hydrotesting experiments, will be decommissioned and decontaminated. SNL/NM would continue to operate several small HE R&D firing sites and the ECF and its ancillary locations, which would be available for hydrodynamic tests.

This alternative would entail the closure of a number of facilities both at LLNL and LANL. It could also entail the closure of facilities at Pantex and SNL/NM. At LLNL, this would entail the closing of at least Building 812 Complex, Building 850 Complex and Building 851 Complex. The associated support facilities probably would not be impacted by this alternative. At LANL, this would entail the closing of all hydrotesting facilities except those located on TA-15. At TA-15, several of the support facilities would be consolidated into one facility and closure of the idle PHERMEX would continue. At Pantex, at least six outdoor burn areas would be closed. At SNL/NM, at least three outdoor burn areas could be closed if their joint sponsor program, HE R&D, were to concur with a decision from the Hydrotesting Program that these facilities were no longer needed. NTS would maintain operations at BEEF and continue DPE operations at U1a.

Closure of over a dozen facilities would entail a substantial cleanup and D&D effort. Although not heavily contaminated, these facilities all have a substantial amount of reinforced concrete and steel structures designed to withstand sizeable HE explosions. It is estimated that at least 100,000 square feet of hardened concrete and steel structures would have to be dismantled, razed and disposed of.

A.9.2.2 *Consolidation at LANL*

This option integrates all large-scale hydrotesting at the single location of LANL. Since LLNL and NTS both have required capabilities not presently at LANL, this alternative would entail maintaining those facilities presently at LLNL until such time that a new facility which has the capabilities presently at the CFF and Building 801 Complex at LLNL could be constructed. For a description of what such a new facility entails, see Section 3.5.7.1, Building 801 Complex. There are three potential sites at LANL where such a "CFF–like" facility could be constructed. Figure A.9-5 shows these three alternative locations at LANL.

Until such time as these capabilities could be established at LANL, the CFF capabilities at LLNL would have to remain in operation. In addition, it is not anticipated that it would be possible to transfer the capability to conduct experiments requiring very large amounts of HE, presently being conducted at the BEEF, to LANL. Accordingly, under a consolidation of hydrotest capabilities at LANL, the BEEF would still be required to maintain its operational status at NTS and continue DPE operations at U1a.

This alternative would entail a large amount of cleanup and D&D associated with the closure of all hydrotest facilities at LLNL, SNL/NM (based on a joint agreement of the HE R&D Program and the Hydrotesting Program), and Pantex and a substantial number of facilities at LANL. It is estimated that this alternative would entail the closure and clean-up of close to 170,000 gross square feet of hardened concrete and steel structures designed to withstand very large HE explosions.

In this process it would make sense to collocate distant support facilities (storage, staging, and assembly) during the construction of such a facility. The construction of such a facility would involve a two- to three-year process resulting in an 8,000–12,000-square-foot primary structure with two to three smaller support buildings situated on a five to seven acre site.

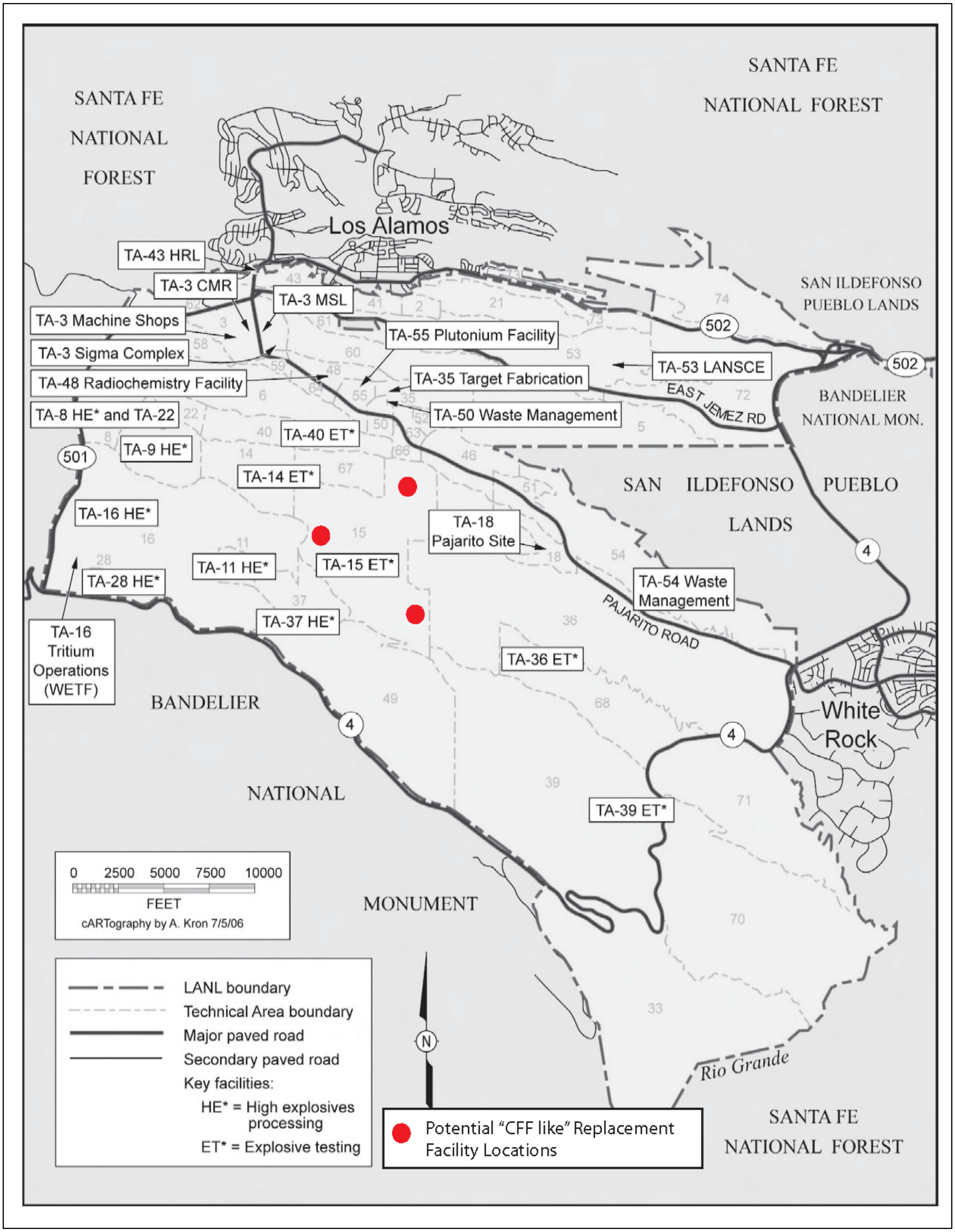


Figure A.9-5—Potential Locations of "CFF-Like" Replacement Facility at LANL

A.9.2.3 *Consolidation at NTS—A Next Generation Alternative*

The next generation hydrodynamic experimental facility would be an improved SNM-capable radiographic facility that would provide for imaging on two or more axes, each with multiple time frame capability, though the number of axes and time frames is still subject to requirements definition and design evolution. The facility would be used to better reveal the evolution of weapon primaries implosion symmetry and boost-cavity formation under normal conditions and in accident scenarios. Due to the nature of the dynamic plutonium experiments and hydrodynamic testing with SNM to be conducted at the facility, the next generation hydrodynamic experimental facility would probably be considered for location at NTS only.

A next generation hydrodynamic experimental facility, either aboveground or underground, would require new building construction and considerable infrastructure (i.e., facilities, equipment, and personnel) in support of test events. Existing infrastructure at NTS might be used to the extent practical. The construction and operational requirements for the next generation hydrodynamic test facility might be greater than that of the DARHT Facility. The impacts associated with construction and operation of facilities based on the different technology approaches could be significantly different. For example, the acreage required could be comparable to or somewhat larger than the nine acres of land resources required for DARHT, but use of proton radiography could require an accelerator comparable in scale to the kilometer-long Los Alamos Neutron Science Center (LANSCE) or to other large accelerators operated by DOE. Based on information on the DARHT Facility, it is estimated that over 250 additional workers would be required for construction and operation of the next generation hydrodynamic test facility. Construction and operation of the next generation hydrodynamic test facility is not anticipated to use large quantities of water. New construction activities would be expected to result in an increase in short-term air emissions. Operation of the next generation hydrodynamic test facility would be expected to have a minimal impact on the air quality considering the impacts projected for DARHT operations. The next generation hydrodynamic test facility would not be expected to impact existing community infrastructure or services in the area; however, depending on the specific design, a proton accelerator could require significant electrical power resources. Waste volumes would not be expected to increase substantially over existing operations at NTS, and waste management associated with dynamic experiments with plutonium at NTS could require additional infrastructure.

In addition to the next generation facility which would be constructed for the consolidation at NTS Alternative, an alternative to also construct a new CFF-like facility at NTS in the 2040 timeframe is also being considered. This facility would be similar to the facility described in the LANL Consolidation Alternative (see Section 3.11.2.2).

A.10 MAJOR ENVIRONMENTAL TEST FACILITIES

Environmental testing supports a primary DOE/NNSA mission of maintaining and demonstrating the safety, reliability and performance of the nation's nuclear weapons systems. The ETFs to support environmental testing are divided into two categories—base ETFs and system ETFs. The base ETFs are those facilities and laboratory scale (or "table-top") items used to evaluate components or subassemblies in the environments defined by the Stockpile-to-Target

Sequence (STS) and the military characteristics requirements for each nuclear weapon in the enduring stockpile. Every laboratory within the DOE/NNSA Complex has some base capability essential for day-to-day operations. The system ETFs are those facilities used to test full-scale weapons systems (with or without SNM or A/D) or those unique major facilities that are applied to development and certification of components, cases, accessories, subsystems, and systems. This SPEIS is focused on the subset of base and system environmental testing facilities, referred to as "major" ETFs that are costly to maintain or have potentially significant environmental impacts. Major ETFs are located at SNL, LANL, LLNL, and NTS.

Section A.10.1 discusses the No Action Alternative, which would continue operations at the existing facilities at SNL, LANL, LLNL, and NTS. Section 3.12.2 discusses an alternative which would downsize facilities in-place. Section 3.12.3 discusses an alternative that would consolidate major ETFs at one site (NTS or SNL), with an option to move the LLNL Building 334 ETF capabilities to Pantex. The analysis of the environmental impacts of the alternatives is contained in Section 5.17.

Major ETF Alternatives
• **No Action.** Maintain status quo at each site. All facilities would be maintained, or upgraded to meet safety and security standards. • **Reduce-in-place.** No duplication of capability within a given site, but there may be duplication from site to site—phase out aging and unused facilities. • **Consolidate ETF capabilities at one site (NTS or SNL/NM).** Would entail closings at sites not selected and construction of new facilities if NTS were selected. This alternative also includes an option to move the LLNL Building 334 ETF capabilities and the LLNL Site 300 Building 834 Complex to Pantex.

A.10.1 No Action Alternative

Under the No-Action Alternative, DOE/NNSA would continue to operate the existing ETFs at the current levels of activity. Only those upgrades and maintenance required to allow for the current activities would take place. ETFs are located at three national laboratories (SNL/NM, LANL, and LLNL) and the NTS. It should be noted that ETF laboratories and capabilities also exist at Pantex and SRS. These facilities, however, are not involved in the R&D or weapon system/component design and qualification process, but instead, utilizes ETF capabilities as an integral part of the production/certification process. Without these ETF capabilities, these sites could not complete their mission. Accordingly, they have not been included in this analysis. Table A.10-1 lists the existing ETF facilities at the three DOE/NNSA laboratories and the NTS.

Table A.10-1—ETFs at LANL, LLNL, Sandia, and NTS

Facility	Size (ft^2)
LANL	
K Site Environmental Test Facility	8,452
Weapons Component Test Facility	22,075
Thermo-Conditioning Facility	6,795
PIXY	6,245
Total	**43,567 ft^2**
SNL	
Simulation Tech Lab	56,886
PBFA Saturn and Sphinx	42,052
ACRR and Sandia Pulsed Reactor Facility[1]	13,793
Radiation Metrology Lab`	1,774
Gamma Irradiation Facility	12,514
Low Dose Rate Gamma Irradiation Facility	206
Auxiliary Hot Cell Facility	13,358
Model Validation and System Certification Test Center	18,842
Centrifuge Complex (including outdoor centrifuge)	15,360
Complex Wave Test Facility	3,459
Sled Track Facility	9,368
Light Initiated HE Test Facility	4,138
Aerial Cable Facility and Control Building	6,808
Radiography Building and Nondestructive Test Facility	6,397
Photometrics/Data Acquisition Complex	13,079
Mechanical Shock Facility	6,600
Mobile Guns Complex	2,400
Thermal Test Complex	15,712
Vibration Acoustics and Mass Properties Lab	8,950
Engineered Sciences Experimental Facility	19,416
Component Environmental Test & Advanced Diagnostic Facility	44,091
Electromagnetic/Environmental/Light Strategic Defense Facility	103,185
SNL/CA Environmental Test Complex	65,964
Total	**484,352 ft^2**
LLNL	
Dynamic Testing Facility (836 Complex)	12,913
Building 834 Complex	4,289
Building 834	6,300
Total	**23,502 ft^2**
NTS	
Device Assembly Facility Area (DAF)	4,790
U1a Complex	2,100
Total	**6,890 ft^2**
Complex Total	**558,311 ft^2**

[1]The reactor itself has been moved to NTS

A.10.1.1 *Environmental Test Facilities at LANL*

LANL has four primary ETFs located within three different Tech Areas: 1) The K Site Environmental Test Facility; 2) The Weapons Component Test Facility; 3) The Thermo-conditioning Facility; and 4) The Pulsed Intensive X-Ray Facility with sled track (PIXY) X-Ray

Building with sled track. The K Site is a large complex consisting of 11 major structures and is located on TA-11. The total size of all facilities at the K Site is 8,452 square feet. Both the Weapons Component Test Facility and the Thermo-Conditioning Rest House are located at TA-16. Together, these two facilities total 28,870 square feet. The PIXY facility is a 6,245 square feet facility located on 194 acres at TA-36. In all, the ETF structures at LANL total 43,567 square feet and are operated by a staff of about 30. Figure A.10-1 shows the location of the LANL ETF facilities. A more detailed description of this facility is as follows:

K Site Environmental Test Facility. The K Site Environmental Test Facility consists of 11 separate structures and is located at TA-11. In all, these 11 structures consist of a total of about 8,452 square feet and occupy a total area of about 10 acres. LANL also has a substantial number of closed ETF facilities which are a function of old age and past downsizing programs. These facilities occupy an area of about 50 acres and are in the process of undergoing D&D and being cleaned up. The following is a description of the 11 existing ETF facilities presently operating at the K Site Environmental Test Facility at LANL:

11-0001 Storage Building. This building was built in 1945 and is used for storage of test equipment that is used to support many of the laboratory and field testing done by LANL/ WT-4.

11-0002 Test Building. TA-11-0002 was built in 1945 and is being used for the angular acceleration test apparatus. It contains various data acquisition systems used to support the angular acceleration testing, as well as other various tests that are conducted in building 11-0002. It has been used in the past for the air-bearing currently housed in TA-16-207, as well as other various tests. It is one of three—11-0002, -0003, and -0004—approved bunkers for personnel protection during high hazard test operations.

11-0003 Control Building. TA-11-0003 was built in 1945 and is currently used as the control room for the TA-11 firing site. It was also used as the control room for the drop tower and burn pit described below. There are various data acquisition systems used to support tests conducted at the drop tower, firing site and burn pit. It is one of three—11-0002, -0003, and -0004—approved bunkers for personnel protection during high hazard test operations.

11-0004 Control Room. TA-11-0004 was built in 1945 and is currently used as the control room for the shock and vibration testing conducted in 11-0030. It contains various data acquisition systems used to support shock and vibration testing, as well as other various tests that are conducted in the building 11-0030. There are capabilities in 11-0030 for remote control of shock and vibration testing in 11-0030. It is one of three—11-0002, -0003 and -0004—approved bunkers for personnel protection during high hazard test operations.

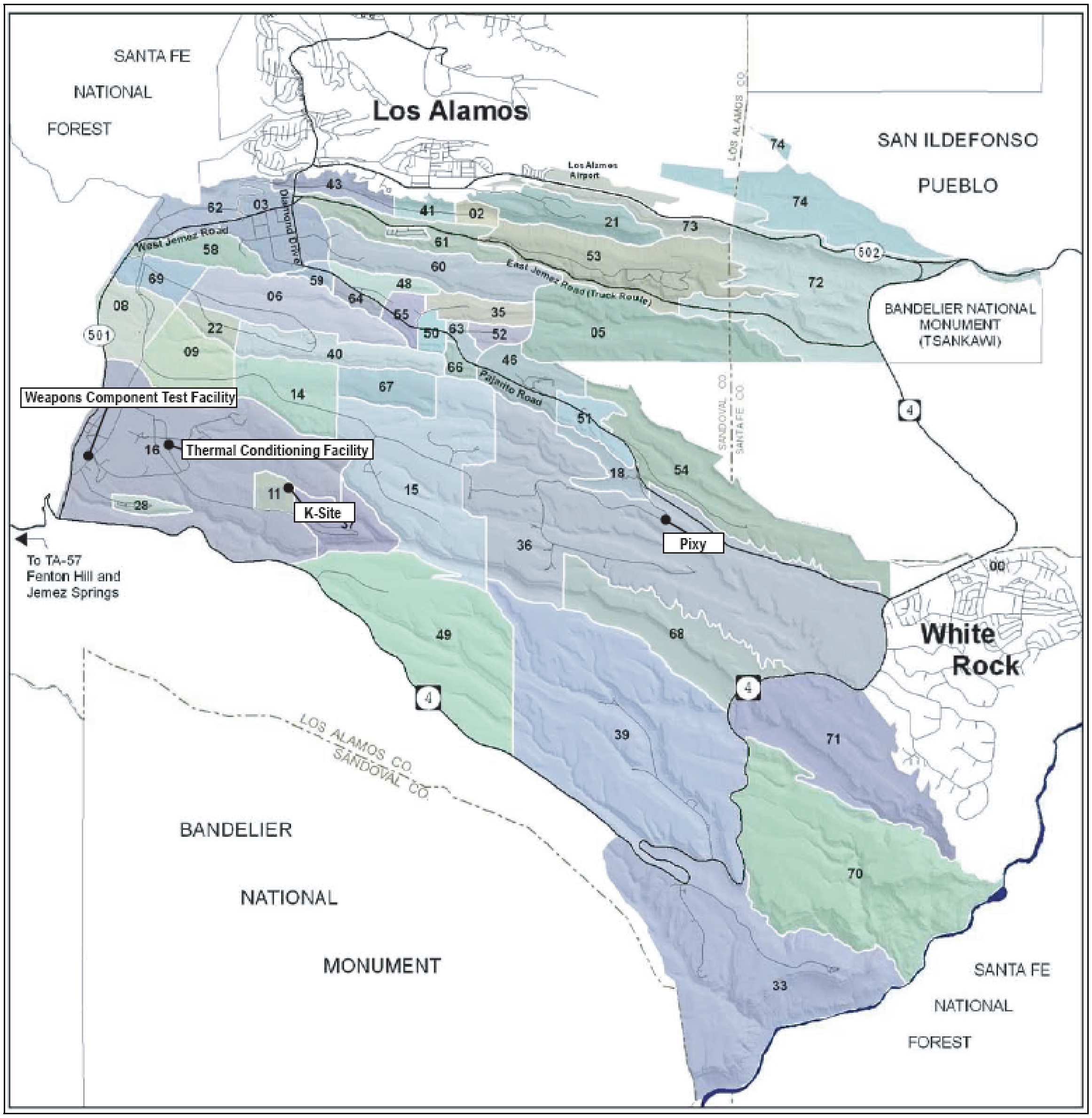


Figure A.10-1—Location of LANL ETFs

11-0024 Office/Shop/Assembly Building. TA-11-0024 was built in 1957 and is currently used an office space for five ETFs, and has housed as many as eight. It is also used as a staging and preparation area for nonhazardous tests. It contains data acquisition systems used to support many tests that are performed by LANL/WT-4. It contains a small staff shop used for basic fixture manufacture and modification.

11-0025 Drop Tower. TA-11-0025 is 165 feet drop tower and was built in the early 1960s. It was used to drop test units from as high as 150 feet. Typical test units included full-up weapons systems, shipping containers as well as other DOE and DoD test units. The drop tower was also used for HE sensitivity test, where HE was dropped from ever-increasing heights until detonation occurred. Acceleration, strain, overpressure and various other data were acquired during testing activities. The drop tower was decommissioned in 2005.

11-0030 Shock and Vibration Test Facility. TA-11-0030 was built in 1957 and now houses the shock and vibration facilities. There are two vibration exciters, an Unholtz-Dickie T-1000 and an Unholtz-Dickie T-4000. These vibration exciters are controlled remotely from 11-0004. Ambient, hot or cold tests can be performed; either alone or in conjunction with shock or vibration on the vibration exciters. 11-0030 also houses a high-g drop machine. This drop machine is approximately 22 feet tall, with a capable drop height of 20 feet. Ambient, hot or cold shock tests can also be performed. TA-11-0030 is also used for free-fall drop testing. Testing with up to 100 pounds of HE can be performed in TA-11-0030

11-0030A Shock and Vibration Amplifier Room. TA-11-0030A houses the power amplifiers used for the Unholtz-Dickie vibration exciters detailed above.

11-0033 Equipment Room. TA-11-33 was built in 1962 and houses an air compressor that supplies house air to TA-11-0030 and TA-11-0030A.

11-0036 HE Magazine. TA-11-0036 was built in 1966 and is a transient HE magazine used for short term storage of HE prior to being used for testing at TA-11-0025.
11-0076. TA-11-0076 was built in about 2004 and is an awning that covers a 2,500-gallon liquid nitrogen Dewar used for thermal testing in TA-11-0030.

Table A.10-2—K Site Environmental Test Facility

	Consumption/Use
Electrical usage	750 KW max
Water usage	1,000,000 GPY
Site size (acres)	10
Building footprint (sq. feet)	8,452
Employment (no. of workers)	3
Total	3
Rad Workers	3
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	0
Non-hazardous (yd^3)	0
Emissions	
NAAQS (tons/yr)	No Monitoring
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air pollutants (tons/yr)	No Monitoring

Weapons Component Test Facility. The Weapons Component Test Facility is located at TA-16. Originally built in the 1950s, this 22,075 square foot building was completely refurbished in the early 1990s. The facility is located on about an acre and a quarter site and supports nuclear weapons stockpile surveillance by providing high-fidelity testing for explosive valves, the portable high-speed data acquisition systems and test instrumentation, and QC-1 R10 compliant testing. An Advanced Diagnostics capability is housed in 16-0207 to develop, design, fabricate, qualify, field, and analyze new measurement applications. These systems include HE Radio Telemetry and fiber optic sensors. A main focus of this capability is not only flight testing of our weapon systems, but the development of new fiber based measurements for a broader customer base. The measurements capabilities include quasi-static component and miscellaneous laboratory and field testing and data analysis on many different systems and components. The data acquisition systems used are NIST-traceable and meet A2LA requirements and are capable of up to 120 channels of long-term logging and high-speed data collection of up to 1 sample per microsecond.

Table A.10-3—Component Test Facility

	Consumption/Use
Electrical usage	450KW
Water usage (gallons per year)	400,000
Site area (acres)	1.25
Building footprint (square feet)	22,075
Employment (no. of workers)	
Total	24
Rad Workers	18
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0.25
Hazardous(yd^3)	0
Non-hazardous (yd^3)	0
Emissions	
NAAQS (tons/yr)	No Monitoring
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air pollutants (tons/yr)	No Monitoring

Thermo-Conditioning Facility. Also located at TA-16 is the Thermo-Conditioning Facility. This 6,795 square foot facility, consisting of five structures, is located on about a three-quarter acre site, and houses the thermal conditioning capabilities. The facility consists of a walk-in thermal chamber and a small stand alone thermal chamber. HE and non-HE tests can be performed with up to 500 pounds of HE. There are also tensile test machines that can be used in conjunction with thermal testing.

Table A.10-4—Thermo-Conditioning Facility

	Consumption/Use
Water usage	250,000 GPY
Site area (acres)	.75
Building floor space (square feet)	6,795
Employment (no. of workers)	2
Total	
Rad Workers	2
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	0
Non-hazardous (yd^3)	
Emissions	No Monitoring
NAAQS (tons/yr)	No Monitoring

Table A.10-4—Thermo-Conditioning Facility (continued)

	Consumption/Use
Radionuclide emissions (Ci/yr)	No Monitoring
Hazardous air polluants (tons/yr)	0

Pulsed Intense X-Ray (PIXY) Facility with sled track. The PIXY is a world class radiographic facility with a combined sled track and gun range capability. This 6,245 square foot facility, located on a large site of about 194 acres. The x-ray capability of the facility is less than 100-nanosecond pulse and stops all motion, even at hypersonic speeds. The X-Ray penetrates 6 inches of steel and the timing of PIXY and other diagnostics to 3 nanoseconds. The facility is capable of high speed photograph to 2,000,000 frames per second. There are oil storage tanks that support PIXY at this site.

Table A.10-5—Pulsed Intense X-Ray Facility with Sled Track (PIXY)

	Consumption/Use
Water usage	Minimal
Site area (acres)	194
Building and structure footprint(ft^2)	6,245
Employment (no. of workers)	
Total	0
Rad Workers	0
Average Dose to Rad Worker (mrem)	0
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	0
Non-hazardous (yd^3)	0
Emissions	
NAAQS (tons/yr)	0
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

A.10.1.2 *Environmental Test Facilities at LLNL*

As a nuclear weapons design facility, LLNL has been involved with weapons testing virtually since its inception in 1952. However, the construction of large scale environmental testing facilities didn’t begin until the late 1950s and early 1960s. By 1970 there were a total of 37 buildings associated with weapons testing with approximately 48 people assigned to weapons testing activities. Weapons testing at LLNL was at its peak in 1985 with 46 buildings and roughly 55 people working on testing related activities. Today, LLNL’s ETF program consists of seven people operating three facilities consisting of nine operational buildings. These three facilities consist of a total area of 23,502 square feet occupying a total site area of 17.75 acres. There is not a specific and dedicated crew of test technicians or engineers assigned to any of the individual test facilities listed below. Rather, the Weapons Test Group (WTG) that operates the ETF facilities has stewardship to maintain all the facilities and provide support staff to the appropriate building in order to conduct and complete the necessary testing. The WTG has a total of six workers, which provide support over all the facilities listed below. Specifically there are three test technicians and three test engineers. The technicians and engineers rove to each of the buildings on an as-needed basis to perform the required testing. The following is a description of the three LLNL ETF facilities:

Building 334 (Hardened Engineering Test Building). Bulding 334 is a 6,300 square foot facility located on a 2.5-acre site in the Superblock section of the LLNL main site. This facility is often referred to as the Hardened Engineering Test Building (HETB). The building is primarily used for environmental testing of SNM. One half of the building is the Radiation Measurement Facility, including the Intrinsic Radiation (INRAD) Bay, and the other half is the ETF, consisting of the Engineering Test Bay (ETB). The two bays are separated from each other by a thick concrete wall. The HETB is a unique facility within the Nuclear Weapons Complex (NWC). With regard to INRAD measurement testing, it is currently the only building within the NWC that allows intrinsic radiation detection of SNM on configured assemblies (outside of drums or containers) and without significant background radiation present. The INRAD facility supports measurement operations for Nonproliferation, Homeland and International Security Division (NHI), the Accident Response Group (ARG), the Joint Technical Operations Team (JTOT), and radiation detector development work. With regard to environmental testing, Building 334 is currently the only building within the NWC that can facilitate environmental testing of SNM (i.e., pits and secondary assemblies containing SNM). Environmental testing includes vibration, shock, thermal conditioning, or combinations of these environments. Figure A.10-2 shows the location of Building 334 in Superblock, at LLNL.

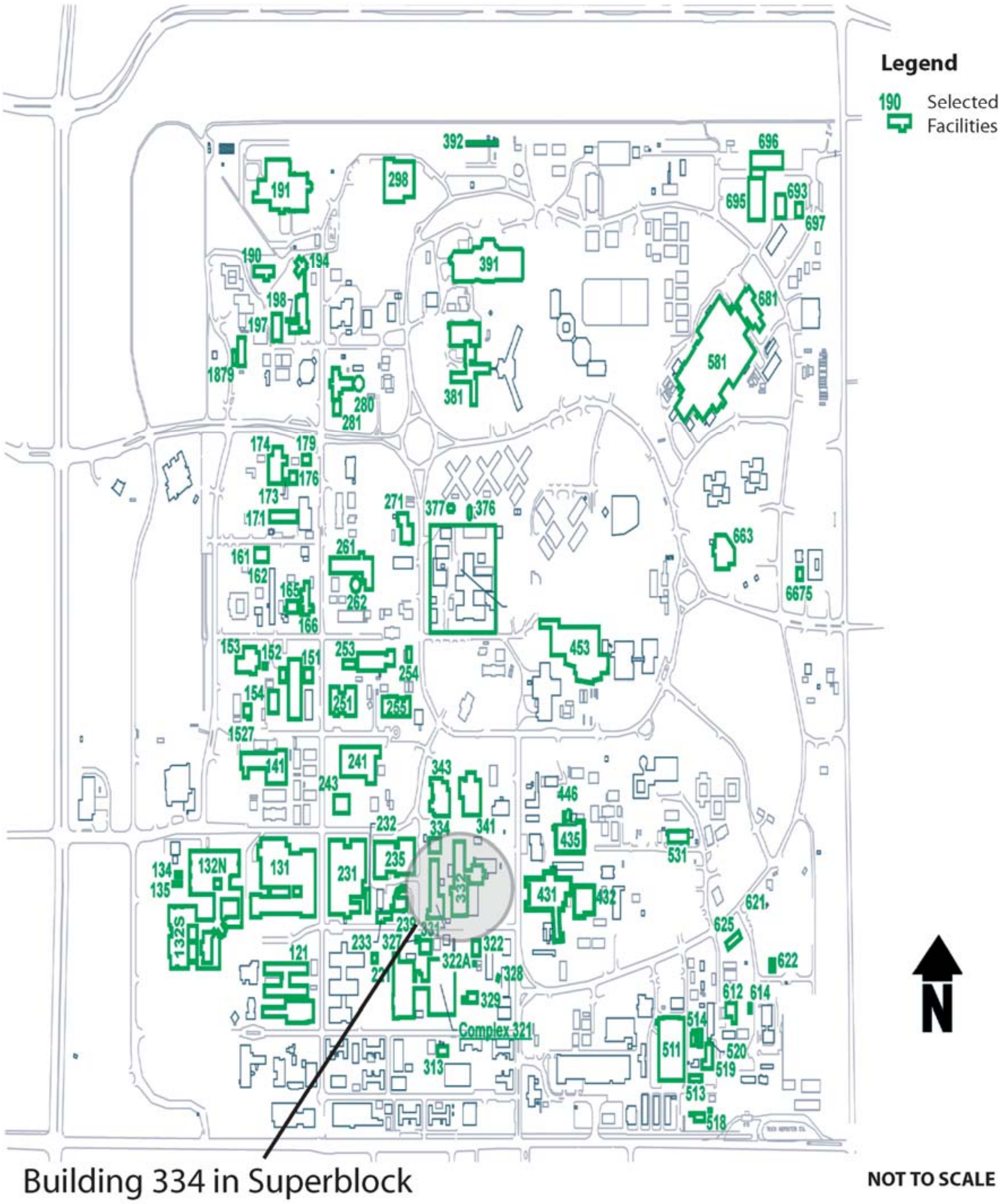


Figure A.10-2—Building 334 in Superblock at LLNL

Table A.10-6—Data Table for Building 334

Date of Construction	June 1985
Type of Building	Reinforced concrete
Building Footprint (ft^2)	6,300
Annual Electrical Energy Use (MWh)	~ 480
Water Requirements (gal per year)	< 2000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0.006
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Figure A.10-3—Build. 834 Complex and Build. 836 Complex at Site 300

Building 834 Complex at Site 300. The 834 Complex is comprised of four buildings totaling 4,289 square feet located of an 11.5 acre site in the Site 300 area of LLNL. The facilities located at this complex are used for thermal and humidity testing of weapons components and systems. The original layout had a total of 12 buildings, but through downsizing efforts now only four are used for thermal testing (one control room, two test cells, and one temporary storage magazine). The strength of the test facilities at the 834 Complex is the ability to test large weapon assemblies with large quantities of HE. In addition to testing of HE, the 834 Complex has the authorization basis to test other hazardous materials commonly found in legacy weapon assemblies. Figure A.10-3 shows the location of Building 834 Complex, at Site 300, at LLNL.

Table A.10-7—Data Table for Building 834 Complex

Number of ETF Buildings	4
Date of Construction	June 1960
Type of Building	Reinforce concrete and modular steel framed
Site area (acres)	11.45
Combined Building Square Footage (ft^2) (combined for all 4 buildings)	4,289
Annual Electrical Usage MWh	~ 400
Water Requirements (gal per year)	< 4000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies
NAAQS emissions	
CO (tons/yr)	0.0026
NOx (tons/yr)	0.0120
PM10 (tons/yr)	0.0009
SOx (tons/yr)	0.0008
HAPs (tons/yr)	0.0002
POC's (tons/yr)	0.0010
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Building 836 Complex at Site 300. The Building 836 Complex consists of four buildings, with a total size of 12,913 square feet, located of a 3.75-acre site in the Site 300 Area of LLNL. This facility is used for dynamic testing of full-up weapon assemblies containing high explosives or other hazardous materials. The four buildings include: one control room, two test cells, and one storage building. The strength of the test facilities at the 836 Complex is the ability to test large weapon assemblies with large quantities of live HE. The authorization basis also allows for testing of other hazardous materials commonly found in Legacy systems. The types of testing performed in the complex are vibration, shock, spin, jerk, and some impact. The test cells are also capable of providing simultaneous thermal conditioning during testing. Figure A.10-4 shows the location of Building 836 at Site 300, at LLNL.

Figure A.10-4—Building 836 Complex at LLNL

Table A.10-8—Data Table for Building 836 Complex

Number of ETF Buildings	4
Date of Construction	June 1970 (3), June 1982 (1)
Type of Building	Reinforce concrete
Site area (acres	3.75
Combined Building Footprint (sq. ft.) (combined for all 4 buildings)	12,913
Annual Electrical Use (MWh/yr)	~ 450
Average Water Requirements (gal/yr)	< 4000
Average Steam (tons)	0
Chemical use	~ 0 (incidental use of isopropyl alcohol, standard degreasers, and epoxies
NAAQS emissions	
CO (tons/yr)	0.0039
NOx (tons/yr)	0.0182
PM10 (tons/yr)	0.0013
SOx (tons/yr)	0.0012
HAPs (tons/yr)	0.0003
POC's (tons/yr)	0.0015
Lead (tons/yr)	0
OZONE (tons/yr)	0

A.10.1.3 *Environmental Test Facilities at Sandia National Laboratory*

SNL/NM has 19 major ETF complexes, each with multi-operational capability. These facilities have a combined footprint of 462,390 square feet. These facilities as shown in Figure A.10-5 are briefly described below.

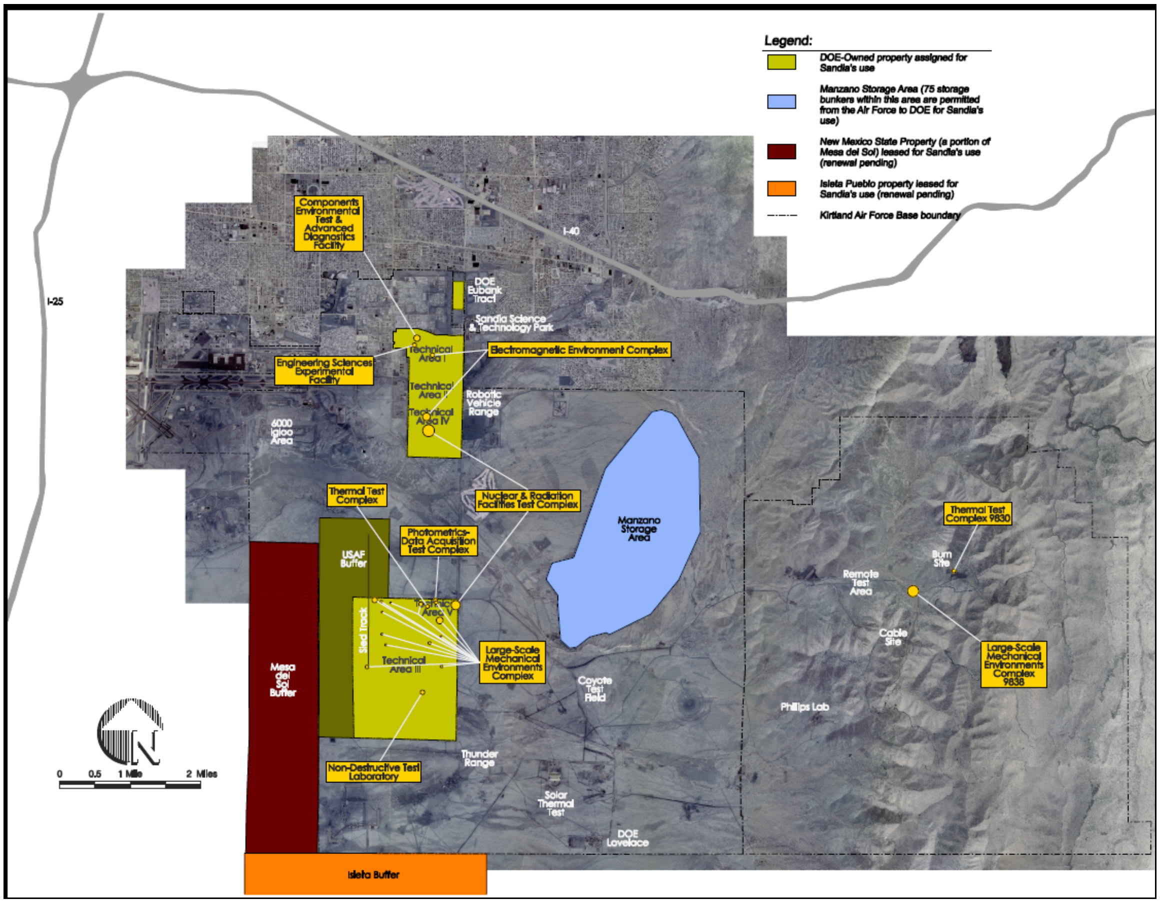


Figure A.10-5—ETF Facilities at SNL/NM

Simulation Tech Lab Hermes III and Repetitive High Energy Pulsed Power. HERMES III is a 56,886 square foot FXR facility located on about 14.5 acres. HERMES III produces high-energy x rays (up to ~20 MeV) by the bremsstrahlung process, providing high spectral and temporal fidelity environments for physical simulation testing to STS prompt gamma radiation requirements. No other U.S. facility can provide these testing capabilities at the subsystem level. Without HERMES III, reentry systems cannot be qualified to STS prompt gamma requirements. The capability is critical for qualifying electronic subsystems. In the large test cell, these bremsstrahlung sources can also stimulate high-fidelity source region electromagnetic pulse (SREMP) environments for nuclear weapon as well as other military system testing. In addition, physical simulation modes utilizing direct deposition of the accelerator's electron beam in experiment objects have been developed and utilized for structural response model development and validation. There are no high-fidelity testing facilities for these responses, and validated models are critical for adequate system qualification.

HERMES III operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set.

Eight full-time equivalent positions from this crew are associated with HERMES III, with various mechanical and electrical engineering and technician positions along with administrative and ES&H personnel. In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H support and Facility Maintenance and Operations Committee (FMOC) maintenance of real property.

Table A.10-9—HERMES III & RHEPP

Site size (acres)	14.4
Building Square Footage (ft^2)	56,886
Electrical Use (MWh per year)	~ 480
Water Requirements (gal/yr)	2000
Average Steam (tons)	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0.006
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

PFBA Heavy Lab Saturn and Sphinx. Saturn is designed to produce intense x-ray pulses, providing physical simulation for STS hot and cold x-ray requirements. Saturn can be configured for either bremsstrahlung x-ray sources or plasma radiating sources (PRS).

In bremsstrahlung mode, Saturn simulates hot x-ray environments, producing a broad spectrum of x rays peaking near 50 keV energy, extending up to nearly 2 MeV. The x rays are generated in a 17-nanosecond full width at half maximum (FWHM) pulse providing high spectral and temporal physical simulation (testing) fidelity for hot x-ray requirements for heavily shielded full subsystems such as an arming, fuzing and firing (AF&F) subsystem. No other U.S. facility can provide adequate x-ray environments. Without Saturn, reentry systems cannot be qualified to STS x-ray requirements. Physical simulation (testing) at Saturn is required for system qualification to hot x-ray requirements. In bremsstrahlung mode, Saturn also provides critical physics discovery and model validation data for microelectronics and circuit x-ray response.

In PRS mode, Saturn provides atomic line or combined atomic line/continuum x-ray sources up to 3 keV in energy. There are no U.S. facilities to provide adequate cold or warm x-ray testing environments. Therefore, the PRS sources on Saturn are used to acquire material property data for model development and model validation, including support for system qualification computational simulations.

Saturn operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set. Fourteen FTE positions from this crew are associated with Saturn, with various mechanical and electrical engineering and technician positions, along with administrative and ES&H personnel. In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H utilities, and maintenance of real support.

SPHINX has both bremsstrahlung and direct electron beam deposition modes of operation. Accelerator power is approximately a factor of 250 below that of Saturn. SPHINX provides fast turnaround capability (cycle time, five minutes) for dose-rate studies of microelectronic devices as well as material response research in direct electron beam mode. SPHINX has supported qualification of the W76-1 electronic subsystems as well as the W76-0, W76-1, and W78 neutron generators. SPHINX provides a cost-effective capability for a large volume of experiments that would otherwise be done at significantly more expensive facilities (on a per test item-shot basis) such as Saturn.

SPHINX operations are conducted by a crew of 23 that maintains and operates the Saturn, HERMES III, and SPHINX facilities, with certain specialized skills shared amongst the set. One FTE position from this crew is associated with SPHINX (primarily an electrical/mechanical technician with some administrative and ES&H support). In addition, the facility relies upon the corporate infrastructure to provide the various areas of ES&H support and FMOC maintenance of real property.

Table A.10-10—Saturn and SPHINX

Site area (acres)	2
Building Square Footage (ft^2)	42,052
Electrical Usage (MWh/yr)	450
Average Water Requirements (gal/yr)	1000
Employment	24
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0

Table A.10-10—Saturn and SPHINX (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Annular Core Research Reactor (ACCR) and Sandia Pulsed Reactor. The ACCR is a 13,793 square foot facility, which is a critical element in the neutron vulnerability and hardness testing and certification of stockpile weapon systems electronic components (e.g., transistors, integrated circuits), subsystems (e.g., fire sets, neutron generators), and systems (e.g., AF&F system). The ACRR is also a critical element in the hostile environment testing of weapon system physics packages (both primary and secondary) at the full-up system level, as well as material sample tests. In addition, the ACRR performs neutron radiographic nondestructive examinations of weapons systems components (e.g., neutron generators). The Complex Transformation strategy includes the need for a responsive infrastructure to design, develop, and field new weapon systems if needed, and/or repackage current systems. As noted above, the ACRR would be critical to the neutron vulnerability and hardness testing and certification in such cases. Also, the ACRR would be critical to the neutron vulnerability and hardness testing and certification of primary and secondary components and systems for the RRW program.

The ACRR directly subjects the part/device being tested to a neutron (and gamma) irradiation environment that simulates the neutron spectrum anticipated from an endo-atmospheric threat. The environment can be produced over long periods of time (e.g., minutes to hours) in a steady-state operation mode or very short periods of time (10–100 milliseconds) in a pulse-operation mode. The irradiation location is accessible for cables that transmit power/signals to the device being tested, and/or receive operational and diagnostic signals from the device being tested. Under appropriate work controls, the device being tested can even include components which contain explosives that can be detonated while being irradiated. These testing capabilities allow for a customer to determine and/or assess the function, failure, and recovery characteristics of the device being tested within neutron-gamma irradiation test environments that simulate STS threat levels. In addition, the ACRR also has a neutron radiography capability to allow customers to perform nondestructive examination of components to search for small defects or other conditions not otherwise detectable.

The ACRR facility includes a relatively modern control room panel with computer-aided control and diagnostic systems, and a newly installed (2005–2006) heat rejection system for long duration steady-state operations. Aging reactor power monitoring devices are being replaced as time and funding allow.

Table A.10-11—Annular Core Research Reactor and Sandia Pulsed Reactor

Site area (acres)	2
Building Square Footage (ft^2)	13,793
Electrical Usage (MWh/yr)	475
Average Water Requirements (gal/yr)	2000
Employment	42
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

The Sandia Pulsed Reactor (SPR) Facility shown in Figure A.10-6 is a 6,099 square foot facility located on about two tenths of an acre, in conjunction with the ACRR. The SPR was a fast-burst reactor used for neutron testing. The SPR directly subjected the part or device being tested to a neutron (and gamma) irradiation environment which simulated the neutron spectrum anticipated from an exo-atmospheric threat. The reactor, itself, as well and the SNM from the SPR, has already been moved to NTS and the facility is not presently in operation.

Figure A.10-6—Sandia Pulsed Reactor

Table A.10-12—Sandia Pulsed Reactor

Site area (acres)	.2
Building Square Footage (ft^2)	6,099
Electrical usage (MWH/yr)	450
Average Water Requirements (gal/yr)	2000
Employees	42
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0

Table A.10-12—Sandia Pulsed Reactor (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Radiation Metrology Laboratory (RML). The RML is a 1,774 square foot facility, which provides measurement of dosimetry for high-dose applications of exposure to neutron and gamma environments (Table A.10-13). This critical capability provides the underpinning for the SNL/NM radiation effects experimental facilities for dose and dose rate measurements. Dosimeter measurements for neutron environments specifically include the fast burst reactors (SNL/NM-SPR, WSMR-FBR), epithermal reactors (ACRR), gamma irradiation environments (Gamma Irradiation Facility [GIF], Low Dose Rate GIF [LDRGIF], HERMES), along with other NNSA test facilities as requested (LANSCE). The RML includes a wide variety of radiation measurement tools, dosimetry, and equipment, including alanine, sulfur, thermoluminescent dosimeter (TLD), alpha spectroscopy, and germanium detectors. The main RML facility is located at SNL/NM TA V, with a satellite laboratory in TA IV to support the pulsed power facilities. All system calibrations are traceable to the National Institute of Standards and Technology (NIST), and measurement procedures follow American Society for Testing Materials (ASTM) international consensus standards.

Table A.10-13—Radiation Metrology Laboratory

Site area (acres)	1
Building Square Footage (ft^2)	1,774
Electrical Usage (MWh/yr) Energy	205
Average Water Requirements (gal/yr)	1000
Employment	3
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
Sox (tons/yr)	0
HAPs (tons/yr)	0
POC’s (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	

Table A.10-13—Radiation Metrology Laboratory (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Other)	
Liquid (gal)	0
Solid (yd^3)	0

Along with radiation effects facility experiment support, the RML provides numerous radiation interrogation techniques for a variety of experiments including: specialty R&D projects in the field of radiation testing and measurements, fuel enrichment confirmations, and flux profile mapping of subcritical experiments. The laboratory also has supported environmental analyses for underground storage, such as confirmation of actinide migration through salt columns and other geologic strata. In past operations, the facility has provided direct support to NTS for underground testing as well as mobile testing support for other NNSA laboratories and universities.

Gamma Irradiation Facility (GIF). The GIF is housed in a 12,514 square foot building. The GIF provides for testing, experimentation and system/component performance when exposed to Co-60 gamma environments. The GIF provides extensive flexibility in both high dose rate and total dose testing to support a wide array of radiation effects and experimental needs. Activities include electronic component hardness, survivability, and certification tests for military and commercial applications, weapon component degradation, radiation effects on material properties, and experiments containing radioactive and strategic nuclear materials testing. Typical experimental customers include radiation damage computer modeling testing, support of Qualification Alternatives to Sandia Pulsed Reactor (QASPR) modeling, and National Aeronautics and Space Administration (NASA) and SNL/NM radiation hardnesstesting for space communications, lasers, and satellite systems. The GIF complements the ACRR facility in that it allows for gamma exposure discrimination to better understand both neutron and gamma damage in radiation environments. The GIF is used to precondition neutron dosimeter transistors used for experimental applications in neutron environments, and organic materials R&D testing in nuclear environment applications.

The facility supports calibration of TLD measurement systems used in support of reactor and pulsed-power machine dose measurements. It has also been utilized for the radiation hardness testing for robotic systems used in nuclear material retrieval devices (i.e., “dirty bombs”). The facility is working with LLNL to determine feasibility of relocating the instrumentation calibration capability from NTS to SNL/NM in support of underground testing, should it be required in the future.

The GIF provides three concrete, dry test cells and a 5.5 meters (approximately 18 feet) deep pool for a variety of gamma irradiation experiments with different test configurations, dose rates, and dose levels. To accommodate these specific irradiation needs for experiments, custom features have been incorporated into the GIF design as follows:

- Configurable radiation sources provide different geometries for the source array (e.g., point, planar, circular).
- Shielded windows allow for experiment observation during irradiation.
- Remote manipulators available to facilitate experiment or source handling.

The in-cell facilities are dry, shielded rooms where irradiations are performed with a high-intensity gamma ray source. Typical irradiations performed in the dry cells are at high dose rates (typically on the order of 3 mrem/hr at >1 m [approximately 3.3 ft] from the source) and for short to intermediate durations lasting up to a few days. The facility also provides for future experimental and testing capabilities that would require the radiation shielding provided by the facility experimental test cells.

For the in-pool testing, radioactive sources are held in a submerged irradiation fixture near the bottom of the 5.5-meter (approximately 18 ft) deep pool of demineralized water. Typical irradiations performed in the pool are at moderate and low dose rates and for long durations lasting days, weeks, or months. Dry experiment canisters, which contain test units, are immersed in the pool and positioned in preset locations in the irradiation fixtures. The fixtures are voided of water to provide an unshielded path between the source and the test unit. The pool can store up to 1.5 mega curies of cobalt-60 ($_{60}$Co). The sources are in the form of pins and can be shared between the in-cell irradiation facilities and the in-pool irradiation facilities.

This Hazard Category 3 facility is operated by a facility supervisor and a facility operator as dedicated staff, as well as system engineers, safety basis analysts, facility maintenance techcnicians, a radiological cotnrol technician, and department management.

Table A.10-14—Gamma Irradiation Facility

Site area (acres)	2
Building Square Footage (ft^2)	12,514
Electrical Usage (MWh/yr) Energy	450
Average Water Requirements (gal/yr)	2000
Employment	4
Rad Workers	4
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
Sox (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0

Table A.10-14—Gamma Irradiation Facility (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Low Dose Rate Gamma Irradiation Facility (LDRGIF). The LDRGIF is a 206 square foot facility. The LDRGIF provides the ability to perform Enhanced Low Dose Rate Sensitivity (ELDRS) effect testing to a large number of piece parts for extended periods of time (several years in many cases). The program personnel supported in this application are weapons systems component developers responsible for certifying the reliability of their designs maintained in storage configurations over decades. Additionally, satellite piece parts have been tested to predict device degradation over the lifespan of the program mission. A separate exposure room is equipped with a combination of temperature-controlled ovens and radioactive sources that permit the simultaneous exposure to thermal and gamma radiation environments. Finally, WFO customers, in support of DoD missions, use the facility.

Attractive features of the facility are simplicity of operation, adequate shielding for personnel working in manned spaces, the use of special form sources, low inventories of source materials, security controls for classified components, an existing infrastructure of radiation protection, industrial hygiene (IH), training, maintenance, administrative, and security support.

The facility is operated by a single operator [1 FTE] with approximately 10 percent of an FTE for supervision and management. This radiological facility is supported by approximately 7.5 percent of an FTE.

Figure A.10-7—Low Dose Rate Gamma Irradiation Facility

Table A.10-15—Low Dose Rate Gamma Irradiation Facility

Site area (acres)	.5
Building Square Footage (ft^2)	206
Electrical Usage MWh/yr)	450
Average Water Requirements (gal/yr)	2000
Employement	2
Rad Workers	2
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Generation	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0

Table A.10-15—Low Dose Rate Gamma Irradiation Facility (continued)

Waste Generation	
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Auxiliary Hot Cell Facility (AHCF). The AHCF is a 13,358 square foot facility. The AHCF is used for characterizing and repackaging nuclear materials, radioactive materials, and mixed waste materials. The AHCF is designed to allow SNL/NM to safely characterize, treat, and repackage radioactive material for reuse, recycling, or ultimate disposal. It is designed to be operated as either a radiological or Hazard Category 3 nuclear facility, depending on material at risk quantities campaigned within the facility. The facility's main purpose is to support the de-inventory of security category 3 and 4 nuclear materials from SNL/NM. The facility systems provide for remote handling capabilities for existing and future items. SNL/NM has an inventory of legacy nuclear materials that are excess to SNL/NM but not necessarily excess to the DOE Complex. Some of these materials have been designated as "no defined use" (NDU). Current disposition plans specify that some of the materials will ultimately be sent to DOE disposal facilities.

The AHCF also provides short-term storage for radioactive materials and wastes. In addition to handling low-level radioactive material, the AHCF has remote-handling capabilities to allow for the characterization and repackaging of high-level radioactive materials and waste. The AHCF is located in the high-bay area of Building 6597 at SNL/NM. The AHCF consists of three parts: 1) A hot cell with two storage silos in the floor (inside the cell) and access ports in the roof; 2) A work area next to the hot cell with a permanent shield wall, a fume hood, and six storage silos in the floor; and 3) Space for material storage. The building contains remotely operated bridge cranes, hot cell manipulators, and video capability. Six-inch floor silos are available for short-term storage of materials during material campaign processing. The silos are 15 feet deep; four are 9-inch diameter and two are 30-inch diameter. A remote electric chain hoist is used in conjunction with the bridge cranes to introduce material into the hot cell. The hot cell is a 10 feet by 10 feet square, it is lined with stainless steel for ease of decontamination, and it contains a one-ton jib crane.

The AHCF is currently not operational. DOE has not granted authorization for operation because of limitations and concerns in the DSA for the facility. The facility is being planned for use as a radiological facility to handle low quantities of nuclear materials for disposal processing.

Many of the Legacy material packages will require repackaging at the AHCF because of their Hazard Category quantities or because their form requires remote-handling capabilities. These packages contain uranium oxide in various forms, miscellaneous radioactive materials, depleted uranium, experiment packages and scrap parts, metallographic samples, a small quantity of thorium, and several Americium Beryllium sources.

During operations, the facility is staffed with one facility supervisor, two facility technicians, a radiological control technician, and department management. As a Hazard Category 3 nuclear facility, additional support staff include system engineers, safety basis analysts, and facility maintenance techcnicians.

The AHCF is a temporary life facility and is intended to support material removal. Its project length of operation is approximately eight years from initial startup.

Table A.10-16—Auxiliary Hot Cell Facility

Site area (acres)	1.7
Building Square Footage (ft^2)	13,358
Electrical usage (MWh/yr)	450
Average Water Requirements (gal/yr)	2000
Employement	2
Rad Workers	2
Avg dose to rad worker	500 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Large Scale Mechanical Environments Complex. The Large Scale Mechanical Environments Complex is a collection of test facilities used to simulate a wide variety of mechanical environments that a weapon system or subsystem might experience as specified by the STS document. These facilities support development, qualification, and acceptance testing; model validation experiments; and other weapon systems evaluations. The facilities included in this complex for purposes of this EIS are: the Model Validation and System Certification Test Center, Centrifuge Complex, Complex Wave Test Facility, Sled Track Facility, Aerial Cable Test Facility, Radiography Building and NDT Test Facility, Photometrics/Data Acquisition Test

Complex, Mechanical Shock Facility, and Vibration-Acoustics and Mass Properties Facility. In addition to the tests that utilize facilities, open air firing of explosives (>1 Kg) are used to expose nuclear weapon systems and subsystems to shock environments as part of the qualification process for abnormal or hostile environments. These impulses provide loadings to drive structural responses that can be measured and analyzed in conjunction with computational results. These detonations can be used to drive planar pressure waves using blast tubes, spherical pressure waves using a free charge, or high velocity flyer plates for impact studies. These tests are typically conducted in the open area at the sled track facility, but can also be conducted in open areas at other approved facilities in the Large Scale Mechanical Environments Complex such as the aerial cable and burn site facilities. The complex also includes advanced diagnostic capabilities which are used to analyze system response, interpret hardware failures, and to support model validation efforts. The core of this complex is the Model Validation and System Certification Test Center, which supports all of the centrifuge, mechanical shock, rocket sled tracks, radiant heat (part of the thermal test complex), vibration, and complex wave facilities that are remotely located to allow for testing of hazardous items.

Model Validation and System Certification Test Center (MVSCTC). The MVSCTC is located in TA-III and housed in Building 6584. This 18,842 square foot building, located on a 3.5-acre site, supports development, qualification, and acceptance testing; model validation experiments; and evaluation of weapon components and other hardware. In addition to providing an office complex for staff, it contains laboratories that support the development and fielding of advanced diagnostics. The MVSCTC contains a small chemical inventory, but no radioactive materials. The chemicals used are typical cleaners, lubricants, solvents, paints, and adhesives that could typically be found in a light lab setting. The building also houses classified and unclassified computing capabilities, a visualization complex for the interpretation of experimental data, and control capabilities to allow for the remote control of seven experimental capabilities in TA-III. characteristics and site infrastructure requirements of the MVSCTC and are shown in Table A.10-17.

The 29-foot centrifuge supports both the vibrafuge and the superfuge capabilities. These are unique capabilities developed at SNL/NM that allow additional environments (vibration and vibration/spin) to be applied to systems while being spun by the centrifuge.

Table A.10-17—Model Validation and System Certification Test Center

Site area (acres)	3.5
Building Square Footage (ft^2)	18,842
Electrical usage (MWh/yr)	750
Average Water Requirements (gal/yr)	1000
Employement	0
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0

Table A.10-17—Model Validation and System Certification Test Center (continued)

NAAQS emissions	
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd3)	0
TRU	
Liquid (gal)	0
Solid (yd3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd3)	0
Hazardous	
Liquid (gal)	0
Solid (yd3)	0

Centrifuge Complex. Located in TA III, the Centrifuge Complex consists of an outdoor 35-foot centrifuge with five support buildings and an indoor 29-foot centrifuge with three support buildings. The complex encompasses a total floor space of 15,360 square feet, situated on a site of about four and a half acres. The two centrifuges in this TA III facility generate high-acceleration environments to certify weapons components and systems, satellite systems, guidance systems, and transportation containers. Both the 35-foot (outdoor) and 29-foot (indoor) centrifuges simulate Reentry Vehicle (RV) launch and reentry environments, aircraft maneuvering accelerations, crash and impact decelerations, and other acceleration environments within the STS envelope, and support environmental sensing device testing on bomb and missile systems. The 29-foot centrifuge supports both the vibrafuge and superfuge capabilities. These are unique capabilities developed at SNL/NM that allow additional environments (vibration and vibration/spin) to be applied to systems while being spun by a centrifuge. Four technical personnel operate both centrifuges.

The Centrifuge Complex contains a small chemical inventory but no radioactive materials as shown in Table A.10-19. Cleaners, lubricants, solvents, paints, and agents are used in small quantities. Compressed gases used in the assembly areas include acetylene and oxygen, argon, and helium. Chemical emissions, including alcohols, ketones, and other solvents, are associated with various aspects of surface preparation, cleaning, and material processing, including quality control. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Radioactive air emissions are not produced at this facility. Noise from centrifuge operation, collision impacts, and explosive testing does occur. Fragments resulting from centrifuge-launched explosives are recovered shortly after test events.

Table A.10-18—Centrifuge Complex

Site area (acres)	4.5
Building Square Footage (ft^2)	15,360
Electrical Usage (MWh/yr)Energy	750
Average Water Requirements (gal/yr)	2000

Table A.10-18—Centrifuge Complex (continued)

Employement	10
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd3)	0
Hazardous	
Liquid (gal)	0
Solid (yd3)	0

The 29-foot centrifuge (Figure A.10-8) generates high-acceleration environments to certify weapons components and systems, satellite systems, guidance systems and transportation containers. There are no radioactive materials at this facility, only cleaning and degreasing chemicals are used at this facility.

Figure A.10-8—29-Foot Centrifuge

Table A.10-19—29-Foot Centrifuge

Site area (acres)	2
Building Square Footage (ft^2)	12,671
Electrical Usage (MWh/yr)Energy	750
Average Water Requirements (gal/yr)	2000
Employment	10
Rad Workers	0
Avg dose to rad worker	0
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
Sox (tons/yr)	0
HAPs (tons/yr)	0
POC's (tons/yr)	0
Lead (tons/yr)	0
OZONE (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0

Table A.10-19—29-Foot Centrifuge (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0
Nonhazardous (Sanitary)	
Liquid (gal)	0
Solid (yd^3)	0

Complex Wave Test Facility. The Complex Wave Facility, located in Building 6610 in TA-III, is a 3,459 square foot facility located on a little more than a half acre site. This facility supports development, qualification, and acceptance testing of weapon systems for normal shock and vibration environments. The facility can be operated remotely, which enables testing of systems that include hazardous and explosives materials. The electrodynamics shakers, control systems, and data acquisition systems are located within a vault-type room (VTR), which simplifies logistics associated with testing of classified articles. Characteristics and site infrastructure requirements of the Complex Wave Test Facility are shown in Table A.10-20.

Building 6610 has the highest force-rated shakers at SNL/NM and is used extensively for system-level tests of full-scale assemblies or items requiring high vibration levels. For fast and efficient setup, two UD T4000 electrodynamic shakers have been dedicated for vertical and horizontal testing, respectively. The facility has state-of-the-art control and data acquisition systems, allowing for up to 200 channels of data sampled at 102 kilohertz.

Controlled dynamic simulations are performed on test articles ranging from small subsystem components to full-scale assemblies. Tests include random vibration, shock on shakers, sinusoidal vibration, mixed-mode vibration, tracked resonant dwells, and combined temperature and vibration. Recent testing has included weapons, satellite subsystems, rockets and payloads, reentry vehicles, and shipping configurations.

Table A.10-20—Complex Wave Test Facility

Site area (acres)	0.5
Building Square Footage (ft^2)	3,459
Electrical usage (MWh/yr)	750
Average Water Requirements (gal/yr)	1000
Employement	1
Rad Workers	1
Avg dose to rad worker	20 mrem/yr
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
Sox (tons/yr)	0
HAPs (tons/yr)	0
POC’s (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0

Table A.10-20—Complex Wave Test Facility (continued)

Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd^3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0

Light Initiated High Explosive (LIHE) Facility. The LIHE Facility is a 4,138 square foot facility located on a little more than a two acre site. The primary purpose of the SNL/NM LIHE facility is to simulate cold x-ray-induced shock loading from an exo-atmospheric nuclear blast, primarily investigating structural response. This one-of-a-kind facility and technique can induce load levels in varying distribution (such as cosine distributions), including load discontinuities. The facility accomplishes this testing by the remote-controlled spray application of a sensitive primary explosive onto the surface of complex structural shapes. The explosive is simultaneously detonated over the sprayed surface by exposing it to an intense flash of light generated by 40 kilovolts to 208 kiloJoules capacitor bank. An emerging technology at the LIHE facility is to drive a thin metallic flyer plate with the silver acetylide-silver nitrate (SASN) explosive. Targets of various geometries, such as flats, rings, cylinders, cones, and RVs can be impacted with representative impulse distributions as well as varying pressure pulse profiles. The LIHE facility is chartered by SNL/NM in concurrence with DOE/NNSA to: 1) Establish and maintain the LIHE impulse testing capability at SNL/NM; 2) Maintain the LIHE facility to modern operating standards; 3) Support the development and qualification testing of nuclear weapons for DOE/NNSA; and 4) Provide test data for use in validation of computer models developed for the Stockpile Stewardship Program.

The LIHE facility operated continually from 1971 to 1992, when it was mothballed at the end of the Cold War. In 2001, a decision was made to reconstitute the cold x-ray impulse test capability at SNL/NM by restoring the facility to its prior capabilities. Because of the onsite New Mexico Environmental Department permitted Thermal Treatment Facility, where excess explosive and explosive contaminated materials are treated, the restoration of the LIHE facility was constrained to its original location at Building 6715 in TA-III. During the time between mothball and restart, the physical condition of 6715 deteriorated to the point that a full renovation of the building was required. Characteristics and site infrastructure requirements of the LIHE Facility are shown in Table A.10-21.

Table A.10-21—Light Initiated High Explosive Facility

	Consumption/Use
Electrical usage(KW/yr)	550
Water usage(gal/yr)	2,000
Site area (acres)	2
Total building square footage	4,138

Table A.10-21—Light Initiated High Explosive Facility (continued)

Employment (no. of workers)	
Total	6
Rad Workers	
Average Dose to Rad Worker (mrem)	
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	0
Non-hazardous (yd^3)	0
Emissions	
NAAQS (tons/yr)	0
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

Sled Track Facility. The 10,000-foot sled track is on a 1,941 acre site consisting of 16 support buildings located in TA-III. The support buildings include observation towers, storage sheds, transformer pads, a total of about 9,368 square feet of buildings. This facility supports weapons system qualification testing and weapons development efforts that must simulate penetration, flight, high-acceleration, and high-shock environments. The simulated environment may be provided through impact, reverse ballistic, or ejection testing. This testing includes shock/laydown tests for bombs, sled ejection tests to verify parachute and laydown performance, impact tests on transportation and container systems, impact fuze tests for reentry vehicles, and a variety of other DOE and DoD system tests that require high-speed impacts.

In addition to tests using the sled track, open air explosive firings greater than one kilogram are used to expose nuclear weapon systems and subsystems to shock environments as part of the qualification process for abnormal or hostile environments. These impulses provide loadings to drive structural responses which can be measured and analyzed in conjunction with computational results. These detonations can be used to drive planar pressure waves using blast tubes, spherical pressure waves using a free charge, or high velocity flyer plates for impact studies. These tests are typically conducted in the open area at the sled track facility, but can also be conducted at other approved facilities in the Large Scale Mechanical Environments Complex such as the aerial cable and burn site facilities.

Small amounts of chemicals are maintained for use in assembling rocket sleds and test payloads in buildings 6741, 6743, and 6736. These include various adhesives and epoxies used to fasten transducers and similar items. Cleaners, lubricants, solvents, paints, and other such agents may also be used in small quantities. Compressed gases are used in the assembly areas, including acetylene and oxygen (for welding), argon, and helium; and dry nitrogen and carbon dioxide are used for pneumatic actuators. Characteristics and site infrastructure requirements of the Sled Track Facility are shown in Table A.10-22.

Table A.10-22—Sled Track Facility

	Consumption/Use
Electrical usage (KW/yr)	550
Water usage(gal/yr)	2,000
Plant footprint (acres)	1,941
Total building square footage	9,368

Table A.10-22—Sled Track Facility (continued)

Employment (no. of workers)	
Total	0
Rad Workers	
Average Dose to Rad Worker (mrem)	
Waste Generation	
TRU (yd^3)	
Low Level(yd^3)	
Hazardous(yd^3)	
Non-hazardous (yd^3)	
Emissions	
NAAQS (tons/yr)	
Radionuclide emissions (Ci/yr)	
Hazardous air pollutants (tons/yr)	

Figure A.10-9— Sled Track Facility

Aerial Cable Test Facility. The Aerial Cable Test Facility, located in the Coyote Test Field, is a 5,022 square foot facility, consisting of three structures located on about a 2.5-acre site. This facility performs gravity drop and accelerated pull-down tests in support of bomb qualification tests and weapons development activities. This test capability provides controlled simulations of the worst-case impact environments experienced by weapons systems and shipping containers. Gravity drop tests are performed from a cable suspended between two peaks, giving up to a 600-foot vertical distance for acceleration. A rocket-assisted (320-foot sled track) pull-down technique is used to provide higher impact velocities when gravity tests are not adequate. Characteristics and site infrastructure requirements of the Aerial Cable Test Facility are shown in Table A.10-23.

Operations require the use of a variety of chemicals (corrosives, solvents, organics, and inorganics) in gaseous, liquid, and solid forms, in relatively small quantities. No radioactive emissions are routinely produced at this facility. Compressed gases used in the assembly areas include acetylene and oxygen, argon, and helium. There are some chemical emissions, including alcohols, ketones, and other solvents. Small amounts of airborne emissions, including carbon monoxide and lead, are released during explosives tests. Operations associated with preparation of test payloads, fixtures, and rocket sleds involve machining that generates residues, bonding of parts with epoxies, cleaning of parts, and wiping of excess materials.

Table A.10-23—Aerial Cable Test Facility

	Consumption/Use
Electrical usage (KW/yr)	400
Water usage(gal/yr)	2,400
Site area (acres)	2.5
Total building square footage	6,808

Radiography Building and Non-Destructive Test Facility. The Non-Destructive Test Laboratory is a two-building facility, 6635 and 6639, with a total floor space of 6,397 square feet, located on about a 7.5-acre site. The purpose of this facility is to allow the radiographic inspection of full weapon systems that contain HE and/or rad materials. These inspections are often necessary to determine the state of the weapon prior to testing in the large-scale facilities in TA-III. After testing, it is required to inspect the system prior to shipping to assure that the mechanisms have remained in a safe position. The high-energy capabilities of the facility allow for imaging through numerous layers of materials or thick sections. In addition to its primary function, the facility has also been used to evaluate other items such as solid rocket motors and recovered waste drums to quantify the contents to determine if the drums can be processed without further evaluation. Characteristics and site infrastructure requirements of the Radiography Building and Non-Destructive Test Facility are shown in Table A.10-24.

Table A.10-24—Radiography Building and Non-Destructive Test Facility

	Consumption/Use
Electrical usage (KW/yr)	400
Water usage (gal/yr)	2,400
Site area (acres)	7.5
Total building square footage	6,397
Employment (no. of workers)	
Total	6
Rad Workers	0

Photometrics/Data Acquisition Test Complex. The Photometrics/Data Acquisition Test Complex, consists of a 1.2-acre site, a 13,079 square foot building which houses photometric cameras, a collection of mobile data acquisition systems, and two mobile laser trackers. Personnel use high speed digital and film cameras to quantify the performance of test articles subjected to a range of test environments. Typical measurements include velocity, acceleration, angle of attack, and impact angle. The photo results are used to verify the applied boundary and initial conditions in a test, to quantify the response of the test unit to the applied stimulus, and to assist in the development and validation of models for use in our computational simulation tools. At the end of the day, the core of any major experiment is the quality of the data obtained. The capability to obtain time-accurate and spatially resolved information is critical to the qualification of weapon systems and for the development of mathematical models.

Laser Tracker II and III represent unique national assets that provide TSPI and photographic coverage currently unavailable by other means. Historically, the trackers (and slaved video data acquisition) have been used to collect data during rocket sled tests, missile firings, weapon development tests and aerial cable pull-downs. The trackers have supported every major Sandia weapon development program, along with significant work for the DoD. The laser trackers routinely track missiles, rocket sleds, smart munitions, parachute systems, aircraft, and other test items. Test-item ranges up to 25,000 feet and velocities up to 20,000 feet per second can be accommodated with a single tracker system. For trajectories that range beyond 25,000 feet, both trackers can be used in tandem. Under good atmospheric conditions, test ranges up to 50,000 feet can be provided. Targets with speeds up to 6,000 feet per second can be acquired on the fly. Current laser tracker capabilities include:

- Azimuth and elevation pointing accuracy of +/-13 microradians;
- Maximum slew rates of 10 radians/second;
- Maximum accelerations of 150 radians/second/second; and
- Trajectory data rate of 1,000 Hz real-time data to disk.

The mobile instrument unit (MIU) and the mobile instrumentation data acquisition system (MIDAS) are used to record accelerations, pressures, and temperatures with transducers that are hardwired to a test unit that may be positioned in a remote location.

SNL has a host of cameras to choose from to capture photometric information. These capabilities are essential given the variety and types of experiments performed in TA-III. These include infrared cameras, high-speed digital cameras (color and black-and-white), high-speed film, digital still cameras, and other specialized equipment such as streak and framing cameras.

Characteristics and site infrastructure requirements of the Photometrics/Data Acquisition Test Complex are shown in Table A.10-25.

Figure A.10-10—Mobile Laser Tracker

Figure A.10-11—Mobile Instrument Unit

Table A.10-25—Photometrics/Data Acquisition Complex

	Consumption/Use
Electrical usage (KW/yr)	0
Water usage (gal/yr)	0
Plant footprint (acres)	1.2
Total building square footage	13,079
Employment (no. of workers)	
Total	0
Rad Workers	0
Average Dose to Rad Worker (mrem)	0
Waste Generation	0
TRU (yd^3)	0
Low Level (yd^3)	0
Hazardous (yd^3)	0
Nan-hazardous (yd^3)	0
Emissions	
NAAQS (tons/yr)	0
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

Mechanical Shock Facility. The Mechanical Shock Facility, located in TA-III and housed in Building 6570, is a 6,600 square foot facility. The facility provides controlled impact and shock environments to support subsystem- and component-level development and qualification testing and to model development and validation activities. This facility houses two horizontal pneumatic actuators (18 inch and 12 inch) and their associated sled tracks (95 feet and 75 feet, respectively) (Figure A.10-12) and two bungee-assisted vertical shock machines. Each actuator can support sled and reverse ballistic speeds up to 250 feet per second. Characteristics and site infrastructure requirements of the Mechanical Shock Facility are shown in Table A.10-26.

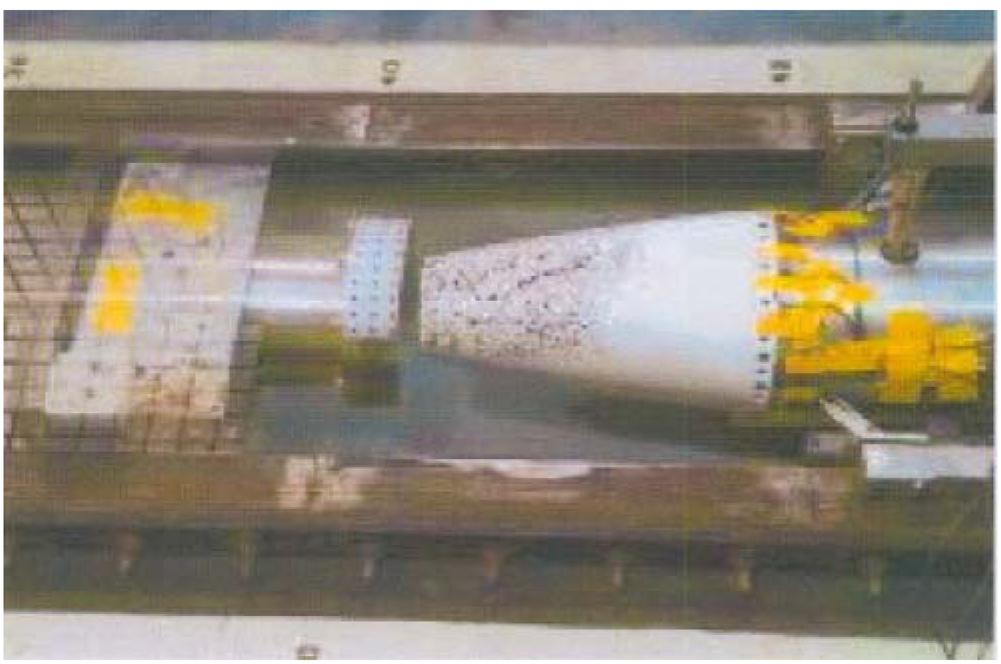


Figure A.10-12—Mechanical Shock Facility Pneumonic Actuator and Sled Track

Table A.10-26—Mechanical Shock Facility

	Consumption/Use
Site area (acres)	
Building Square Footage (ft^2)	6,600
Electrical Usage (MWh/yr) Energy	
Average Water Requirements (gal/yr)	
Employment	
Rad Workers	
Avg dose to rad worker	
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POCs (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd^3)	0
TRU	
Liquid (gal)	0
Solid (yd3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd^3)	0
Hazardous	
Liquid (gal)	0
Solid (yd^3)	0

Vibration-Acoustics and Mass Properties Facility. The Vibration-Acoustics and Mass Properties Facility, located in TA-III and housed in Building 6560, is an 8,950 square foot facility. The large-scale vibration-acoustics facility also houses mass properties operations, providing system-level vibration and shock environment testing capabilities to certify weapons systems (bombs, missile warheads, and reentry systems) to the normal STS environment specifications and to support model development and validation activities. These environmental requirements include transportation, launch, flight, and reentry shock and vibration simulations on full-scale weapons systems. The test capabilities include normal shock and vibration, combined vibration and acoustics, and combined thermal and vibration environments The Mass Properties Facility provides capabilities to completely characterize the mass properties (weight, center of gravity, moments of inertia, and products of inertia) of full weapon systems.

All of the capabilities have the option of being operated and monitored remotely for tests involving HE or other hazardous materials. Recent improvements have included converting the building into a limited area and creating a VTR in the mass properties high bay.

Characteristics and site infrastructure requirements of the Mechanical Shock Facility are shown in Table A.10-27.

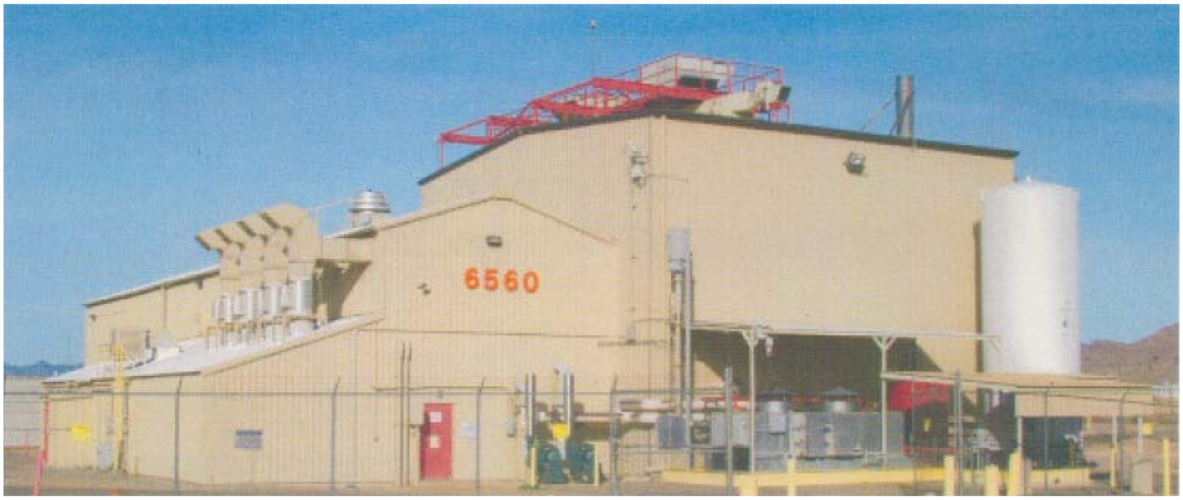


Figure A.10-13—Vibration-Acoustics and Mass Properties Facility

Table A.10-27—Vibration-Acoustics and Mass Properties Facility

	Consumption/Use
Site area (acres)	
Building Square Footage (ft2)	8,950
Electrical Usage (MWh/yr) Energy	
Average Water Requirements (gal/yr)	
Employment	
Rad Workers	
Avg dose to rad worker	
Chemical use	
NAAQS emissions	
CO (tons/yr)	0
NOx (tons/yr)	0
PM10 (tons/yr)	0
SOx (tons/yr)	0
HAPs (tons/yr)	0
POCs (tons/yr)	0
Lead (tons/yr)	0
Ozone (tons/yr)	0
Waste Category (accumulated quantities from 2002 to 2006)	
Low level	
Liquid (gal)	0
Solid (yd3)	0
TRU	
Liquid (gal)	0
Solid (yd3)	0
HLW/Spent Fuel	
Liquid (gal)	0
Solid (yd3)	0
Hazardous	
Liquid (gal)	0
Solid (yd3)	0

Mobile Guns Complex. The Mobile Gun Complex (Figure A.10-14) is a large multi-acre facility with no permanent buildings. The Mobile Gun Complex consists of three Davis guns and one gas gun. The Davis guns are smooth-bored guns in 8-, 12-, and 16-inch diameters, mounted on mobile carriers. These barrels are open at both ends and employ a moving mass recoil system. This recoil system allows the guns to be trailer mounted and mobile. The 8- and 12-inch barrels are interchangeable on the same trailer, while the 16-inch gun has a dedicated trailer. Each Davis gun trailer includes a hydraulic power unit, a winch for hoisting the load into the barrel, and the hydraulic cylinders necessary to elevate the barrel and operate the stabilizers. The gas gun is a six-inch diameter gun. It is also trailer mounted for mobility. It contains an onboard compressor and two air storage tanks with a capacity of 27 cubic feet each. These tanks are fed directly by the compressor and are capable of storing compressed air up to 5000 psi. These storage tanks feed the firing chamber, which is 7.2 cubic feet. All guns are hinged to allow firing angles from horizontal to vertical. Characteristics and site infrastructure requirements of the Mobile Guns Complex are shown in Table A.10-28.

The guns have limitations on the size and weight of the projectiles they can deliver. The 16-inch guns can achieve a launch velocity of approximately 1,200 feet per second for a 2,000-pound, 16-inch projectile, including sabot and pusher plate assemblies. The maximum weight of a gas gun projectile/sabot assembly is approximately 120 pounds for similar impact velocities.

These mobile guns are unique in that they provide a capability for component (fuze), subsystem, or full-scale penetration testing into in situ target materials (limestone, granite, layered geologies, etc.) in addition to engineered targets. The mobile guns provide a controlled environment for Hi-G impact conditions (velocity, angle of obliquity, angle of attack, etc.) along with high-fidelity photometric coverage or other off-board measurements. These unique capabilities provide cost-effective alternatives for risk mitigation, qualification, and failure investigations to sled or flight testing.

The mobile guns primarily provide support to penetrating weapons programs for DoD and DOE. The guns are also used in support of other Federal agencies, including the Japanese Lunar A space program. Recently, DoD has performed more full-scale testing with the Davis guns, while DOE programs have utilized the gas gun for component qualification and acceptance testing. SNL/NM maintains a capability for full-scale testing of its NW Penetrator, the B61-Mod11 test with the Davis guns. There are no permanent structures, and the guns are mobile. Seven staff are required to manage and operate this program.

Figure A.10-14—Mobile Guns Complex

Table A.10-28—Mobile Gun Complex

	Consumption/Use
Electrical usage	400
Water usage (gal/yr)	2,000
Site area (acres)	1
Total building square footage	2,400
Employment (no. of workers)	
Total	7
Rad Workers	0
Average Dose to Worker (mrem)	
Waste Generation	
TRU (yd^3)	
Low Level(yd^3)	
Hazardous(yd^3)	
Non-hazardous (yd^3)	
Emissions	
NAAQS (tons/yr)	
Radionuclide emissions (Ci/yr)	
Hazardous air pollutants (tons/yr)	

Thermal Test Complex (TTC). The TTC is a four-building complex, with a total floor space of 15,712 square feet, located on a 10-acre facility in TA-III. This facility demonstrates through testing that the nuclear weapon stockpile is safe from inadvertent nuclear detonation in abnormal thermal environments. All weapons systems, as part of the weapons design, qualification, and initial certification process, have to demonstrate that they fail safely in fire environments. TTC contains the test facilities, diagnostics, and highly trained personnel to perform such qualification work. Characteristics and site infrastructure requirements of the TTC are shown in Table A.10-29.

Numerous risk assessments have demonstrated that fire, either alone or in combination with other environments, is a dominant contributor to risk. During accidents, fire occurs frequently when in the presence of fuels, such as are common in transportation modes. Further, fire presents a severe thermal threat to weapon systems. They are not intended to survive, but they must safely fail.

Computational advancements in the coming decades will improve ability to cost effectively test weapons systems as part of design, qualification, and certification but will not replace testing for at least another century. It must be shown that the weapon system maintains a positive safety margin throughout a failure transient so pervasive that the system is rendered irreversibly inoperable. Failure is atomistic in nature and the length scale range is beyond scientific prediction until computational machines become many orders of magnitude larger. On the other hand, engineering prediction has become an invaluable design-of-experiment tool and is considered an indispensable part of the testing process. Cost-effective testing is not possible without computational modeling.

Historically, it has not been necessary to conduct abnormal thermal environment testing with SNM. Acceptable measurement and computational methods exist for making the extrapolation from test articles without SNM. There is no evidence to suggest that the future will force a change in what has been accepted historically in this regard. If anything, it can be expected that advancements in computing will only solidify the testing basis without SNM.

Weapon system owners use the TTC during all phases of design and initial qualification. It is also used to address significant findings and for nonroutine testing to support the technical basis for annual assessments. Testing includes safety critical components such as capacitors, subsystems, fire sets, and full-up systems. The facility includes multiple environment capability. Examples include ovens and humidity chambers for prepping hardware, test bays for evaluating thermal properties of materials such as thermal diffusivity, and test chambers for fire environments. Fire environments can be cost effectively simulated electrically using radiant heat panels as is often done during the design phase. Fires can be created with gaseous or liquid fuels up to 20 MW.

The TTC consists of Fire Laboratory for the Accreditation of Models and Experiments (FLAME), Cross-wind Test Fire Facility (XTF), radiant heat cells, laboratories, and an outdoor test site in Lurance Canyon for larger, open fires. The FLAME and the XTF were designed with optical access for advanced optical diagnostics to further the multidisciplinary sciences underlying turbulent reacting flow as part of the goal to make fire models more predictive. In addition to weapon system owners, other nuclear weapons users include the computational model developers. The test facilities within the TTC are unique in the world in that they were specifically designed (by CFD fire models) to provide controlled, reproducible boundary conditions necessary to validate fire and thermal response models. The TTC is operated by a staff of twelve.

Table A.10-29—Thermal Test Complex

Electrical usage (MWh/yr)	5.6
Water usage (gal/yr)	4,000
Plant footprint (acres)	10

Table A.10-29—Thermal Test Complex (continued)

Total building square footage	15,712
Employment (no. of workers)	
Total	12

Electromagnetic/Environmental/Lighting, Strategic Defense Facility. The Electromagnetic Environs Complex consists of three buildings located on approximately 19.5 acres. This 103,185 total square foot facility consists of the following capabilities: Mode-Stirred and Anechoic Chambers—The Mode-Stirred and Anechoic Chambers are used alone or in combination for Radio Frequency (RF) measurements. The Mode-Stirred Chamber provides a reverberant environment in which electromagnetic fields are statistically uniform, providing 360-degree, homogeneous coverage of test items in a single test run regardless of test item orientation. The Anechoic Chamber simulates a free-field environment where test items are illuminated in a directional manner dependent on the source antenna. Both types of testing have their advantages and disadvantages, but the combination supports the strengths of both. In addition, testing in these chambers can be done at 220 megahertz (MHz) and above. The combination of these chambers with the Electromagnetic Environments Simulator (EMES) in TA-I (250 MHz and below) allows for electromagnetic characterization over a very broad frequency range.

Electromagnetic Environments Simulator (EMES). EMES is a building-sized Transverse Electromagnetic (TEM) cell, which supports electromagnetic plane wave illumination of test objects. Two electromagnetic (EM) sources are used at the facility, low-frequency Electromagnetic Radiation (EMR) and an Electromagnetic Pulse (EMP) simulator. The TEM cell structure can theoretically support frequencies as low as DC (or 0 hertz [Hz]); however, the current amplifier at the facility can be used from 100 kHz to 250 MHz. This gives good low-frequency coverage to support higher frequency measurements in the Mode-Stirred and Anechoic Chambers in TA-IV. The EMP simulator design is based on Mil-Std 2169B requirements and is unique in its fast-rise-time pulse combined with a large range of electric field amplitudes that can be generated.

EMES supports a portion of the frequency range of nuclear-weapon STS EMR environments as well as high-altitude EMP environments. Every weapon has these environmental requirements in most, if not all, weapon stages called out in their respective STSs. EMES was used during 2006 in the EMR mode to characterize electromagnetic leakage into the air-launch cruise missile (ALCM) and Advanced Cruise Missile as part of the W80-3 qualification effort. While the W80-3 program was cancelled, the cruise missile information is still useful for the W80-1 stockpile system, and it has been planned to include this information in the W80 STS. EMES was also used in 2003 and 2004 to conduct EMP testing of commercial items for the congressionally chartered EMP commission.

SNL/NM Lightning Simulator. The SNL/NM Lightning Simulator can replicate severe direct-strike lightning to meet stockpile needs for assuring nuclear safety in lightning environments. The Lightning Simulator can also be used to generate nearby lightning environments, which are a normal-environment concern for reliability of electronic systems. It can generate lightning-like pulses that meet the top one percent requirements for peak current, pulse width, and rise-time in nuclear weapon STS requirements documents. In the last two years, the Lightning Simulator has been used to characterize a variety of stockpile and new development Lightning Arrestor

Connectors and to qualify the nuclear safety of the W76-1 in lightning environments. The SNL/NM Lightning Simulator is housed in Building 888 on the east end of TA-I at SNL/NM. In the past, an F4 airplane was instrumented and tested at this facility. This part of TA-I has been significantly developed, virtually eliminating the opportunity to test large items outdoors.

Table A.10-30—Electromagnetic Environmental Complex

Electrical usage (MWh/yr)	150
Water usage (gal/yr)	4,000
Site area (acres)	19.5
Building footprint (Sq. feet)	103,185
Employment (no. of workers)	
Total	11
Rad Workers	
Average Dose to Worker (mrem)	0
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	0
Non-hazardous (yd^3)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

SNL/CA Environmental Test Complex. The California Environmental Test Complex provides a number of table-top capabilities (shock, vibration, acceleration, climatic chambers, mass properties, radiography, etc.) used for proof and qualification of weapon systems, subsystems, and components. In addition to the ongoing weapon design activities between LLNL and SNL/CA, this complex also supports WFO (DoD, Department of Homeland Security, Engineering Campaign Six, Model Validation) projects. The shock, vibration, and climatic chambers have been used by the W80 Program for margin testing. They are also used for weapon JTA and GTS activities.

Table A.10-31—SNL/CA Environmental Test Complex

Electrical usage (KW/yr)	550 KW
Water usage (gal/yr)	4,000
Site area (acres)	8.5
Total building square footage	58,038
Employment (no. of workers)	
Total	6
Rad Workers	6
Average Dose to Worker (mrem)	3 mrem/yr
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	40
Non-hazardous (yd^3)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

A.10.1.4 *Environmental Test Facilities at Nevada Test Site*

Two environmental testing facilities are located on NTS, the DAF and the U1a Facility. Both DAF and U1a are considered "user facilities," operated by LLNL and LANL respectively on behalf of the NNSA Nevada Site Office with the site manage and operation providing support, primarily in the area of facility maintenance. Under this concept, the facility is maintained in a "warm standby" condition ready to accept programmatic work. The assigned personnel maintain the facility, its authorization basis, and ensure that programmatic work is properly authorized. The actual programmatic work is conducted by project teams that deploy to the facility to conduct their activities. Thus staffing levels would only reflect the personnel required to maintain the facility in a warm standby condition and not programmatic work. In general, waste streams are associated with project activity and not routine day-to-day activities. These facilities are described below:

Device Assembly Facility Area (DAF). The DAF (Figure A.10-15) is a collection of more than 30 individual steel-concrete buildings connected by a rectangular common corridor. The entire complex, covered by compacted earth, spans an area of 120,000 square feet. It is located within a 19-acre high security area. The operational buildings in the DAF include five assembly cells (Gravel Gerties); four high bays; three assembly bays, one of which houses a glovebox, and one of which houses a down draft table; and two radiography bays. Five staging bunkers provide space for staging nuclear components and high explosives. All material packages arrive or depart the DAF through either of two shipping or receiving bays. The support buildings include three small vaults for staging quantities of high explosives, or SNM; two decontamination areas; two buildings providing laboratory space; and an administration area. Supporting the DAF are an entry guard station and a mechanical/electrical building.

In support of the Critical Experiments Facility (CEF) project, a portion of the DAF (two assembly cells, two high bays, two staging bunkers, and one of the laboratory areas) is undergoing modifications to house the critical assembly machines being moved from Los Alamos TA-18. The nuclear material associated with CEF has been moved to the DAF. This material is being used by various programs to measure the radiation signature of the nuclear material in different configurations. The DAF also supports the assembly of subcritical experiment packages and has been designated as the site for receipt of a damaged nuclear weapon that can not be taken to Pantex. The Nevada Site Office has received direction from NNSA's Principal Assistant Deputy Administrator for Operations to have the approved safety authorization basis for the DAF in place to support a September 2009 operational readiness date to perform specific weapons program work. DAF is being proposed as one siting option for the Engineering Test Bay (Building 334, LLNL), and the ACRR (SNL/NM) has one option within the DAF PIDAS (security area).

Figure A.10-15—DAF at NTS

Table A.10-32—Device Assembly Facility

Electrical usage (MWh/yr)	3,700
Water usage (gal/yr)	4,000
Site area (acres)	19
Building footprint (sq. feet)	4,790
Employment (no. of workers)	
Total	85
Rad Workers	60
Average Dose to Rad Worker (mrem)	30 mrem/yr
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	40
Non-hazardous (yd^3)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0

U1a Complex. The U1a Complex (Figure A.10-16) is a standard industrial hazard facility with demonstrated capabilities to safely conduct nuclear activities including dynamic experiments involving the combination of HE with SNMs. In its current configuration it consists of approximately 1.25 miles of underground drifts located approximately 1,000 feet beneath the surface. Three shafts connect the underground drifts with the surface and provide personnel access, extensive materials handling capabilities, numerous utility systems, and a large diagnostic cable inventory. Improved structures, aboveground, are small and sufficient to enter and exit the facility. Additional underground space can be mined out and tailored to meet experiment/facility requirements. Offices, shops, and diagnostic recording facilities, and parking are located on the surface.

Because of its unique location, 1,000 feet beneath the surface, U1a offers the potential for greatly reducing security costs associated with nuclear facilities and of mitigating any potential offsite exposure to radiation. It has been proposed as a potential site for ACRR (SNL/NM) and for the ETB (Building 334, LLNL).

Figure A.10-16—U1a Complex at NTS

Table A.10-33—U1a Complex

Electrical usage (MWh/yr	3,700MW
Water usage (gal/yr)	5,000
Site area (acres)	2
Building footprint (sq. feet)	2,100
Employment (no. of workers)	
Total	85
Rad Workers	60
Average Dose to Rad Worker (mrem)	30 mrem/yr
Waste Generation	
TRU (yd^3)	0
Low Level(yd^3)	0
Hazardous(yd^3)	40
Non-hazardous (yd^3)	80
Emissions	
NAAQS (tons/yr)	.3
Radionuclide emissions (Ci/yr)	0
Hazardous air pollutants (tons/yr)	0